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Monal(*Lophophorus impejanus*) State bird of Uttarakhand

Photo by : Bhagat Singh



Editorial

“Cheetal” is once again in your hands after a long wait. Even the first and second issue of volume 42 had reached our readers after a long gap. While regretting the delays caused due to prolonged illness of our dedicated Honorary Secretary Mr. I. S. Negi, it may be a good news to our readers and members of the Wildlife Preservation Society of India, that efforts to rejuvenate this society, which is one of the pioneer organisations set up for bringing awareness in the field of Wildlife conservation have earnestly begun. I am sure that the patience of our readers, members and well wishes will not fade due to delay in bringing out the issues of “Cheetal” - in time. With your help, support and good wishes we will try our best to bring out the future issues regularly with quality reading material.

It is most important at this juncture to mention that wildlife and natural resources are under a great pressure from the developing mankind and unless all organisations, institutions and individuals engaged in conservation activities take a leading role, it may not be possible to contain the onslaught of these ever increasing pressures.

The vanishing of Sariska tigers is a warning to all conservationists and nature lovers. There has been a widespread concern not only in India but all over the globe. Our Prime Minister's personal concern can be judged from the fact that he called a meeting of senior field level officers to know the causes and to find the remedy. A task force was constituted to go into its causes and action has already started on the recommendations of the task force.

Tiger, co-predators, their prey species and the habitat in which they live was never monitored before, in the manner in which it was done this year on the all India basis. The protocols for such a monitoring exercise were evolved by Ministry of Environment and Forests, GOI with technical inputs from the Wildlife Institute of India Dehradun and monitoring exercise was done under the unified command of GOI in all the 17 tiger range states of the country. from January to March 2006. This was a massive task involving over 48000 forest beats in all these states which were made the monitoring units and in each of which almost 50 kms. of leg work was done in 6 days time to assess the density of tigers, co predators, prey and the quality of the habitat. The exercise involved not only the Tiger Reserves created under the prestigious conservation scheme, “Project Tiger” but in all the tiger bearing areas outside TRs as well. In second phase of the exercise tiger density would be assessed by camera traps that will be laid in all the Tiger Range States across the country. This has already begun in some states. I was given an opportunity to act as a Internal Observer for this All India Monitory Exercise in 6 of the 17 Tiger Range States. (West Bengal, MP, Karnataka, Bihar, UP and Arunanchal Pradesh). It was a matter of great satisfaction that the exercise in all these states was being conducted as

per the laid down protocol and some more precise results are expected to come from this exercise. It was also a matter of great satisfaction that tiger presence was found in varying densities in all the states visited by me. My earnest request to all the nature loving individuals and organisations is to get deeply involved in such exercises and spread correct conservation picture among the people.

A. S. Negi

Conservation Efforts

1. Mountain Quail (*Ophrysia superciliosa*) believed to be extinct was last shot near Nainital in 1876. The earliest authentic record of its existence dates back to 1836, when a pair was collected from the vicinity of Mussoorie by a British Sportsman.

The Wildlife Preservation Society of India with the financial support from WWF-India has undertaken fresh efforts to rediscover the bird.

2. The Mahaseer sport fish (*Tor pititora*) which abounded the snowfed and other Himalayan rivers in Uttaranchal has reached a stage from where its recovery would be very difficult. A survey of the fish was carried out by Dr. A. J. T. Johnsiah of WII, AS Negi retired Chief Wildlife warden of Uttaranchal and Dhanjay Mohan a Senior Forest Officer of UP Cadre and an expert in birds, in recent past and it was found that the best chances of its revival are in Sarda and its tributaries. Yamuna has become the most unsuitable habitat due to mining and dynamiting. Special efforts would be needed in Ganga and its tributaries, specially the Nayar river which is the most suitable spawning river for Mahaseer. Environment and Angler Association of Dehradun is engaged in efforts to restore the fish and a stretch of river in Ramganga has been taken by them on lease from Uttaranchal Govt. and a "Angling Shack" has been set up at Marchula near Corbett Tiger Reserve.

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DEMOGRAPHIC CHANGES AMONG BATS IN AND AROUND JAISALMER OF GREAT INDIAN DESERTS

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ABSTRACT

A recent survey conducted to explore present status of bats in and around Jaisalmer of Great Indian Desert (The Thar) revealed that this region had seen remarkable change with respect to number of chiropteran species reported from decades back. Out of three microchiropteran species (*Rhinopoma microphyllum kinneari*, *Rhinopoma hardwickii* and *Taphozus perforatus*) reported from the region during the early sixties of twentieth century, two (*Rhinopoma microphyllum kinneari* and *Taphozus perforatus*) had vanished while one (*Taphozus perforatus*) has occupied the various sites of the region in due course of time in bat research.

INTRODUCTION

Bats are the most alluring flying creatures of the nature, which adorn the silent nights of the Great Indian Desert (the Thar). Having 1001 species throughout the world, bats belong to order chiroptera, the second largest order of class mammalia. They are further divided into two sub orders viz., Megachiroptera and Microchiroptera. The Megachiroptera are represented by only one family, the Pteropodidae, which are restricted to the Old World tropics of Africa and Asia and consist of 167 species (Smith, 1977; Mickleburgh *et al*, 1992. Hutson *et al*, 2001). The 834 species of modern Microchiroptera are usually divided into four super families, which indicate the evolutionary affinities among the 17 families (Smith, 1977; Mickleburgh *et al*, 1992. Hutson *et al*, 2001). These super families are the Emballonuriodea, which includes the Rhinopomatidae, Emballonuridae and Craseonycteridae; the

Rhinolophoidea, which includes the Nycteridae, Megadermatidae, Rhinolophidae and Hipposideridae; the phyllostomodean which includes the Noctilionidae, Mormoopidae and phyllostomidae; and Vespertilionidae, which includes the Natalidae, Furipteridae, Thyropteridae, Myzopodidae, Vespertilionidae, Mystacinidae and Molossidae. There is a fifth superfamily, the Palaeochiropterygoidea, that includes three families of fossil Microchiropterans (all extinct), the Paleochiropterygidae, Archaeonycteridae and Icaronycteridae (Bates and Harrison, 1997).

Bats are recorded from all areas of the world except the Arctic, Antarctic and few isolated oceanic islands. More than 20% of all mammal species of the world are bats. In many countries bats are Major contributors to mammalian biodiversity, while in some, particularly small oceanic islands, they are the only indigenous mammals

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Chiropterans, Demographic changes, Jaisalmer, Thar Desert

and may play a vital role as "Keystone" species in ecosystem (Cox *et al*, 1992). The majority of bats species, including most of those in the suborder Microchiroptera are insectivorous, although some are carnivorous, a few are piscivorous, and three species of vampire are sanguivorous. Bats of the Old World suborder Megachiroptera are predominantly frugivorous, but also consume nectar, flower, leaves and occasionally insects. The New World family Phyllostomidae has a similar plant diet, but some species may incorporate a greater proportion of insects than the Megachiroptera. Bats are the only mammals with the capacity for powered flight (Altringham, 1996), and the Microchiroptera, together with the Megachiropteran genus *Rousettus*, have evolved a system of echolocation, by means of which they orient themselves and find their food, and which has enabled them to roost in situations where light intensity is low. In addition, those species living in temperate latitudes are heterothermic and hence able to adapt to food shortage during winter by hibernating; their reproductive cycles have become modified as a result. The most notable reproductive adaptation is a delay in fertilization: mating generally takes place in autumn and spermatozoa are stored in the female reproductive tract until ovulation occurs in the following spring (Racey, 1999).

Worldwide, bats play essential roles in keeping populations of night-flying insects in balance. Just one bat can catch hundreds of insects in an hour, and large colonies catch tons of insects over night, including beetle and moth species that cost farmers and foresters billions of rupees annually, not to mention mosquitoes in our backyards. Throughout the tropics the

seed dispersal and pollination activities of fruit and nectar-eating bats are vital to the survival of rain forests. With some bats acting as "keystone" species in the lives of plants crucial to entire ecosystems. Wild varieties of many of the world's most economically valuable crop plants also rely on bats for survival. Some of the better known commercial products are fruits such as bananas, breadfruit, avocados, dates, figs, peaches, and mangoes. Others include cloves, cashews, carob, balsa wood, kapok (filler for life preservers), and even tequila. Most of the plants from which these products come are now commercially cultivated, but maintenance of wild ancestral stocks is critically important. They are the only source of genetic material for developing disease-resistant strains, rejuvenating commercial varieties, and for producing new, more productive plants in the future. The value of tropical bats in reforestation alone is enormous. Seeds dropped by bats can account for up to 95% of forest regrowth on cleared land. Performing this essential role puts these bats among the most important seed-dispersing animals of both the Old and New World tropics. Studies of bats have contributed to the development of navigational aids for the blind, birth control and artificial insemination techniques, vaccine production, and drug testing, as well as to a better understanding of low-temperature surgical procedures (Tuttle, 1988).

Including 13 Mega and 96 Microchiropterans, India harbours 109 species of bats. Surprisingly out of these 109 species, one the major component of the Great Indian

Desert, the Jaisalmer (26° 54' 47" N and 70° 54' 52" E) were known to have only three Microchiropterans (*Rhinopoma microphyllum kinneari*, *Rhinopoma hardwickii* and *Taphozus perforatus*) in the early sixties of twentieth century (Prakash, 1963). All three Microchiropteran species were reported from the premises of Sonar Fort. *Rhinopoma hardwickii* was observed in four deserted rooms of a building while *Rhinopoma microphyllum kinneari* were inhabited in two other rooms of the same; the later were not as numerous as the former. In two other rooms of another building, specimens of *Taphozus perforatus* were found (Prakash, 1963). After sixties till mid of 2001 not much work was done on distribution and ecology of the bats of this region. In these four decades this arid region of Thar Desert has seen tremendous change in its eco-biogeography. Rapid increase in human population, introduction of Indira Gandhi Canal in the district of Jaisalmer, implementation of advanced technology to enhance agricultural production, massive growth in construction of new buildings, renovation of historical monuments and urbanization are the reasons which lead to inhospitable changes in distribution and availability of the bat species in this area.

ENVIRONMENT OF THE STUDY SITE

Our study site, the Jaisalmer (26° 54' 47" N and 70° 54' 52" E) lies in the western most part of Rajasthan, Climatically it is a typical hot desert type. During the summer the temperature lies in between 25° and 45° C while in May it rises up to 49° C. The annual average rainfall is 200mm distributed over less than twenty rainy days. This wide range of

climatic conditions has formed different types of habitat for the Chiropterans in and around the Jaisalmer city. Vegetation of the area is typical desertic shrub forest type represented by *Acacia senegal*, *Prosopis juliflora*, *Euphorbia caducifolia*, *Ziziphus nummularia*, *Grewia tenesc*, *Salvadora persica*, *Capparis dicydas*, *Callotropis procera*, *Anogeissus pendula*, *Maytenus emarginatus*, *Calligonum polygonoides* and *Commiphora wightii*. The main crops of the region include moong (*Vigna radiata*), moth (*Vigna aconitifolia*) guar (*Cyamopsis tetragonoloba*), til (*Sesamum indicum*), and Bajra (*Pennisetum typhoides*) which are supplemented by wheat (*Triticum sativum*) and barley (*Hordeum vulgare*) due to the introduction of Indira Gandhi Canal. (Rahamani, 1997).

MATERIAL & METHODS

We have undertaken an intensive survey from July 2001-June 2002 to locate the chiropteran roost in and around Jaisalmer within a radius of 20 km. Specimens were collected from the different roosting sites, preserved in seventy percent alcohol and brought to Conservation Assessment and Management Plan Workshop, for South Asian Chiropteran, held at Madurai Kamaraj University, Madurai in the month of February 2002. There they were identified on the basis of morphological measurements by the world-renowned bat taxonomist Dr. Paul J.J. Bates of Harrison Zoological Museum, Kent, England and prominent Indian bat expert Dr. Y.P. Sinha of Zoological Survey of India, Patna. A well-planned survey was undertaken in which information about various bat roosts was collected from the local people and a bat

detector used to locate the minute roosts. We used a Global Position System (GPS) to assess the global position of the roosting sites. We are using a Digital Minimum-Maximum Thermometer and a Digital Lux Meter for the microclimatic study of the bat roosting sites, whereas video-graphic count and capture recapture methos is being followed for the population dynamics.

OBSERVATION AND DISCUSSION

An extensive survey conducted by us (October 2001 to June 2002) to explore the chiropteran roosts in and around Jaisalmer (26°54'47" N and 70°54'52" E) has revealed that the number of Microchiropteran species at the study site has gone down drastically from three to two while no Megachiropteran species has been found in the region. Significantly, out of three Microchiropteran species (*Rhinopoma microphyllum kinneari*, *Rhinopoma hardwickii* and *Taphozus perforatus*) reported from the region during the early sixties of twentieth century, two (*Rhinopoma microphyllum kinneari* and *Taphozus perforatus*) have vanished while one (*Taphozus perforatus*) have occupied the various sites of the region in due course of gaps in bat research. The detailed account of every roosting site of chiropterans in and around jaisalmer is as follows :

(1) Annapurana Bhandar, Sonar Fort (26°54'45" N and 70°54'58" E) :

It is one of the ruined and deserted buildings of the most noteworthy chronological tourist place, Sonar Fort of Jaisalmer which inhabits two Microchiropteran species of the region namely *Rhinopoma hardwickii* and *Taphozus nudiventris*. Basically it is a triple

storey building meant to store food grains for the soldiers and other workers of the king who ruled Jaisalmer. Since long back it is unattended and not being repaired, as a result of which it has become a permanent roosts for the Microchiropterans. Although it has two Microchiropteran species but both of these are showing a partial segregation in terms of their roost. Ground and first floor of the building is dominated by the *Rhinopoma hardwickii*, while wooden ceiling of the second floor is occupied by *Taphozus nudiventris*. *Rhinopoma hardwickii* are found to roost preferably in the corners and fore walls of the building while *Taphozus nudiventris* roost in between the mini gaps and linings of the wooden ceiling. Both of the species of this roost display different behaviour while interacting with the human intruder. Likewise the *Rhinopoma kinneari*, *Rhinopoma hardwickii* first watches the intruder, moves its tail in pendulum like manner, crawls in either direction and finally flies away while *Taphozus nudiventris* doesn't get disturbed and remains calm looing towards the intruder. Copulation has been seen in both species during the month of April, which resulted into parturition during the month of late July and early August.

(2) Raj Mahal Place, Sonar Fort (26°54'51" N and 70°54'48" E) :

It is the prime attraction for the visitors who come here form India and abroad, In fact it is a triple storey historical building meant for use as administrative block by the erstwhile ruler of Jaisalmer. It has an attractive museum consisting of varieties of tools and goods used by the royal family and soldiers. Of course it used to be quite busy

throughout the day but three deserted rooms of this building are serving as one of the habitats for Microchiropteran bats. Although it is quite near to the Annapurana Bhandar it has only one Microchiropteran bat species. Ceilings and staircase of this compartment is occupied by a colony of *Rhinopoma hardwickii*. Previously until the beginning of 2002 central hall of the building was having about 300 individuals of this species but they were forced manually to go away from the site as the hall was being repaired to install new section of existing museum.

(3) Rani Mahal Palace, Sonar Fort (26°54'42" N and 70°54'50" E) :

It is the main building of the fort which was used as the residence of Queens of the Jaisalmer King. Basically it is a triple storey building comprising many small rooms and three big galleries. Out of these, five deserted dark rooms and one gallery is occupied by the *Rhinopoma hardwickii*. It has almost thousand individuals. A few days back this building was under resurrection but significantly bats of the palace did not leave the place. They were sifted to the other rooms of the building during repairing works and re-occupied the original place soon after its completion. But now the authorities of the Fort are trying to get rid of these bats from this building. They are of the opinion that although these bats are not doing any harm to them but visitors get scared of them and they can't afford to leave them inside this building.

(4) Patawa Haveli (26°54' 58" N and 70°54'54" E):

Patawa Haveli is the most alluring visiting site of the Jaisalmer city. It is a huge multistorey building consisting of five sections. All these five sections are the

unique example of engraving. This building was the private property of Patawa family of ancient Jaisalmer but three of its sections are taken over by the Rajasthan Tourism Department. Govt of Rajasthan, while other two are still with them and are being used as residences. Out of these three, two are open for the visitors while third one is completely ruined and closed from the security point of view. Ceiling and fore walls of few rooms of ground and first floor of both the prior sections are occupied by scattered individuals of *Rhinopoma hardwickii*, while all the rooms of the third section are thickly populated with this species. The future of these bats is not much safe because recently Rajasthan Government has granted rupees thirty lakhs for the renovation of these three sections.

(5) Amar Sagar Garden, Amar Sagar Village (26°55'55" N and 70°52' 17" E) :

Amar Sagar is one of the village heritages of Jaisalmer district situated 10 Km. away from the city. At one edge of this village half a hectare land is maintained as garden and is owned by the Royal family of the village. Beside one of its fore walls, a big water reservoir (village pond) exists and just aside that wall there is a ruined building. One of its compartments at the ground floor is occupied by *Taphozus nudiventris*. Although their number is less and restricted upto fifty but their solitary roost in the area is of immense significance.

(6) Shri Adinath Jain Temple, Amar Sagar Village (26°55'45"N and 70°52'18"E) :

Shri Adinath Jain Temple popularly known as "Jain Temple" is the most amazing visiting place in Jaisalmer. It is famous for carving art. It lies opposite to Amar Sagar

Garden. One of its semi underground portions of store is partially occupied by two species of Microchiropteran bats viz. *Rhinopoma hardwickii* and *Taphozus nudiventris*. Although their number is confined within hundred but their permanent roost in the premises of this temple is biologically significant. Moreover an deserted room attached to the boundary wall of the temple is inhabited by a colony of *Rhinopoma hardwickii* consisting of approximately 300 individuals.

(7) Gajroop Sagar Tunnel, Gajroop Sagar Village (26°56'50" N and 70°55'44" E) :

Gajroop Sagar is another village lying in the close proximity of the Jaisalmer city. It has a big water reservoir, which is well known as Gajroop Sagar Pond. Just within a distance of 100 meters towards the Jaisalmer city is the main Water Filter Station. A line of hillocks surrounds one of the sides of this pond and has a man made tunnel to drain water from surrounding area to the pond. The ceiling of this tunnel is profusely colonized by the *Rhinopoma hardwickii*. Structurally it is 165 ft long, 4 ft wide 8' high tunnel and has two openings. So far as Microchiropteran roost in and around Jaisalmer is concerned it seems most suitable because it is free from human disturbance and has wild surrounding. Infra-structurally it is so complicated that no one can dare to enter it. Overall we have no doubt to admit it as the safest site for Microchiropteran bat colonies to flourish. Interestingly now a days it is inhabited by almost 2000 individuals of this bat species.

(8) Gajroop Sagar Wall, Gajroop Sagar Village (26°56'41" N and 70°55'54" E) :

A blind well, lying in between the pond

and Filter Station of the Gajroop Sagar village, is serving as the temporary roost for the Microchiropterans of this region. During winter it used to be occupied by the *Rhinopoma hardwickii* while by the end of February when temperature increases they do vacate it. It is significant to quote here that Microchiropteran bats of the temperate regions undergo hibernation during the winter when atmospheric temperature falls abruptly and food is not available in abundance. During this period they migrate to the wells and other underground locations where the temperature is comparatively high. Throughout the hibernation period they remain lethargic and survive on the reserve fat deposits of their body. As soon as the atmospheric temperature starts rising and conditions become favourable they leave these sites and immigrate to their permanent roosts.

By summarizing the above text we can say that the Jaisalmer, one of the biodiversity hotspots of Great Indian Desert, is not bestowed with the Chiropteran species. It lags far behind Jodhpur (The entrance gate of Great Indian Desert) in terms of number of bat species. On one side where Jodhpur is known to have seven Microchiropteran (*Rhinopoma microphyllum kinneari*, *Rhinopoma hardwickii*, *Taphozus perforatus*, *Taphozus nudiventris*, *hipposideros fulvus*, *Rhinolophus lepidus* and *Pipistrellus mimus*) and one Megachiroptera (*Pteropus giganteus*), Jaisalmer stands nowhere by having only two Microchiropteran species viz., *Rhinopoma hardwickii* and *Taphozus perforatus* (Purohit and Senacha, 2002). Surprisingly it has added one new species (*Taphozus nudiventris*) in last four decades with the loss of two species (*Rhinopoma microphyllum kinneari*). If we analyse this

status with that of Jodhpur, we will find that the Microchiropteran species of the Great Indian Desert are declining very fast. During last four decades Jodhpur too has lost three Microchiropteran species viz. *Megaderma lyra lyra*, *Hipposideros fulvus* and *Tadarida aegyptiaca* (Purohit and Senacha 2002). Moreover both the regions had seen a terrific change in their Chiropteran roosts. The Jaisalmer has added five new Microchiropteran roosts while Jodhpur has seen broad scale change with this regard and added one Megachiropteran and ten Microchiropteran roost with the loss of more than five (Fig1). Interestingly Jodhpur is dominated by the *Rhinopoma microphyllum kinneari*, Whereas *Rhinopoma hardwickii* dominates Jaisalmer (Fig2).

CONSERVATION STATUS

Both the Microchiropteran species of this region (*Rhinopoma hardwickii* and *Taphozus nudiventris*) are assessed as of least concern in South Asia, as per the final report of Conservation Assessment and Management Plan Workshop for South Asian Chiroptera held at Madurai Kamraj University, Madurai, India during 21st to 25th January 2002. But, if we talk about the conservation status of these Microchiropterans in and around Jaisalmer of Great Indian Desert, they might face the severe threat in the near future because, out of eight existing roosts, two are under resurrection (Raj Mahal Palace and Rani Mahal Palace) while two other (Annapurana Bhandar and Patwa Haveli) are supposed to

be resurrected very soon. If it is so, they will face great hardship in searching new safer roosting sites. One other roost (Gajroop Sagar Tunnel) known to be almost safe for *Rhinopoma hardwickii* might face the threat with wild growth of *Prosopis juliflora* at both the openings of the tunnel. Now a days surroundings of this roost is full of massive growth of *Prosopis juliflora*. It is worth stating here that wild growth of *Prosopis juliflora* at the openings of few Microchiropteran roosts in Jodhpur is proving fatal to the species inhabiting them. At one of the Microchiropteran roosts at Jodhpur twenty five bats (*Rhinopoma microphyllum kinneari*) died due to their unexpected trapping in the thorns of *Prosopis juliflora* (Purohit et al, 2002).

CONCLUSION

Overall we can say that *Rhinopoma hardwickii* and *Taphozus nudiventris* are the only species of Microchiropterans reported from in and around Jaisalmer while not one Megachiropterans has been reported till today. It seems that both of these species are secured so far as their roosting threats are concerned. It is obvious to recommend here that a major conservation programme should be launched in the region to ensure the bright future of Chiropteran biodiversity. Preferably the efforts should be made to have meaningful talks with the administrative authorities of the Forts, Havelies and temples. Moreover, people and youngsters of the regions should be educated with regards to the significance and conservation benefits of bats.

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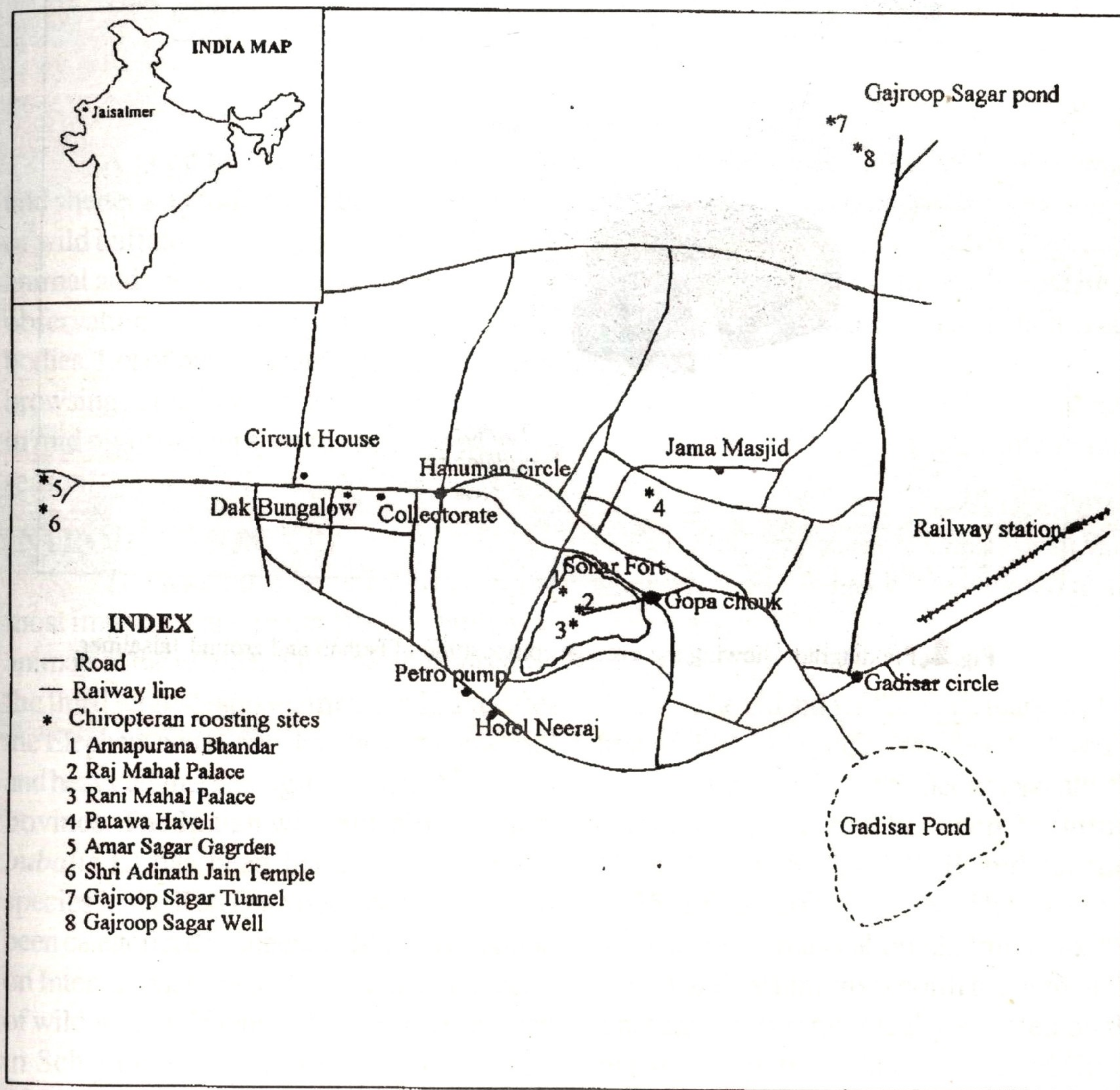


Fig. 1 - Map showing the various chiropteran roosting sites in and around Jaisalmer of Great Indian Desert.

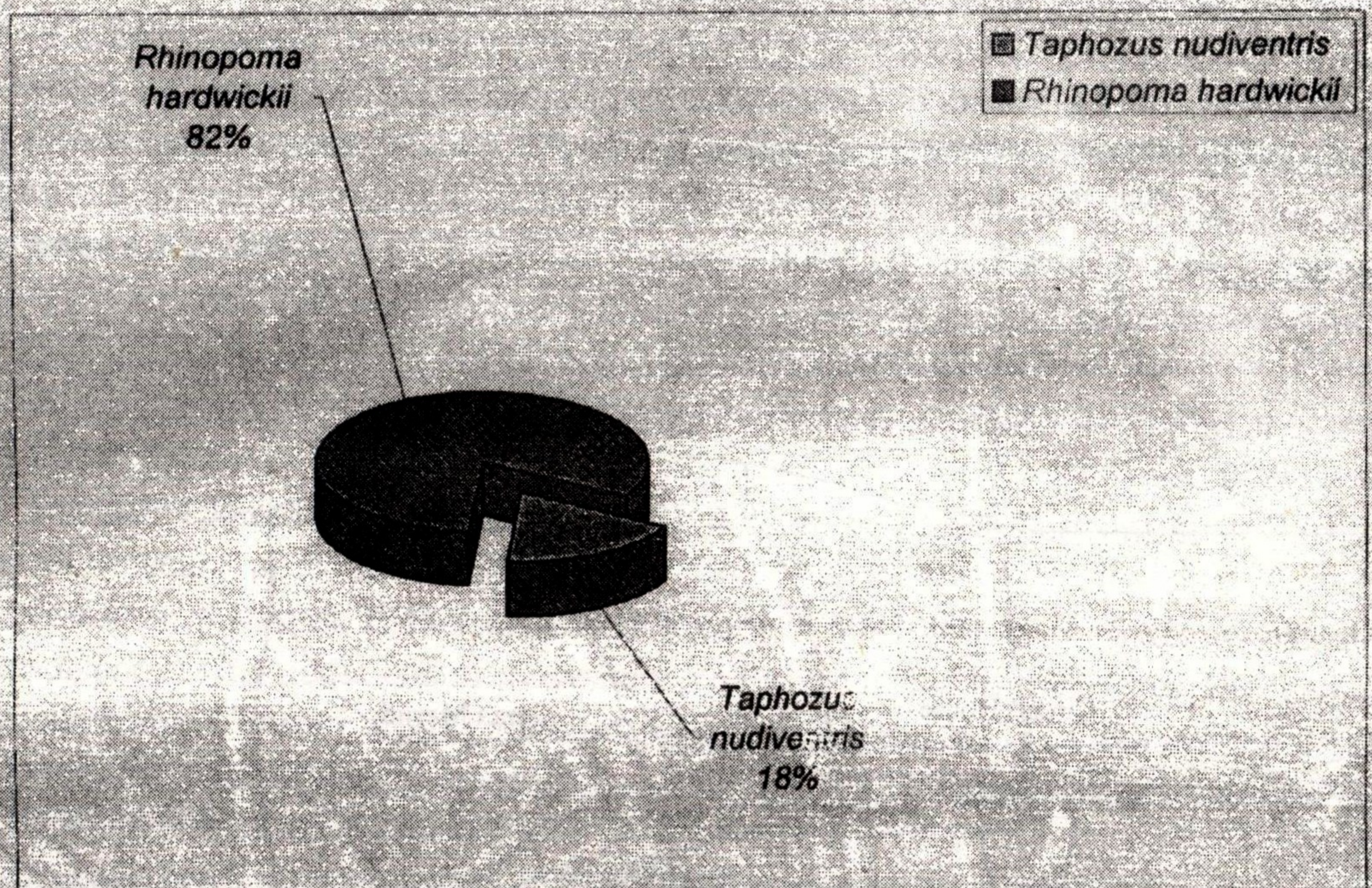


Fig. 2. Pie diagram showing the average composition of bats in and around Jaisalmer.

HABIT AND HABITAT OF WILD BUFFALO (*BUBALUS BUBALIS*.) IN UDANTI WILDLIFE SANCTUARY, CHHATTISGARH

Dr. Rajendra Prasad Mishra*

ABSTRACT

A good habitat is mainly governed by the availability of abundant fodder, water and shelter for the survival of the species. This research paper is based on the habit and habitat of wild buffalo surviving in central Indian region (Udanti WLS). Actually, Wild buffalo is shy animal and spends more time in dense forests particularly during the daytime. The maximum observation was made during summer season particularly on grassland situated near the water bodies. Lot of biotic disturbances take place during daytime, therefore, animals prefer grazing/browsing in the forest rather than the grassland. The peak grazing time of animals was recorded in mid night during summer season, while early morning was recorded during winter & rainy season.

INTRODUCTION

The wild buffalo ranks as one of the most important and magnificently built wild animals in the world today. The wild buffalo is the third largest land mammal in India, after the Elephant and Rhino. It is the most powerful and heavy animal amongst the south Asian wild bovines. The Indian wild buffalo (*Bubalus bubalis* L) has been listed as endangered species in the Red Data book of IUCN. It has been categorized in appendix III of Convention on International Trade of Endangered Species of wild flora and fauna (CITES). It is classified in Schedule I of Wildlife (Protection) Act 1972 of India. All these titles indicate towards considerably reduced range of distribution and population of the species and put the species on high priority for conservation. The studies were conducted in

Udanti wildlife sanctuary of Chhattisgarh State, where the species has been declared as the "State Animal".

STUDY SITE

The Udanti wildlife sanctuary with an area of 237.27 square km. was declared as wildlife sanctuary in 1985. Geographically the sanctuary is located between longitude 82°11'10" to 82°24'10" E and latitude 19°55'30" to 20°11'15" N. The extent of cross section area is about 22 km. from east to west and 19 km. from north to south of the sanctuary. It is strategically situated on the interstate border of Chhattisgarh and Orissa States. The forests of sanctuary are Tropical Moist and Tropical Dry Deciduous types with Sal (*Shorea robusta*) and mixed species (Champion and Seth, 1968). According to Management Plan (Gabrial, 1995) of the

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Key word: Home range, habits, Habitat, machans, genetic swarming, decimating factors, diurnal activity pattern, endangered, biotic disturbances.

sanctuary, the Sal forest is about 34% and that miscellaneous forest is 61.55% while Teak (*Tectona grandis*) has been introduced over about 4.4%. It has a rich component of flora and fauna.

The climate of the area is monsoonic with three distinct seasons viz. rainy (July to October), winter (Nov to Feb,) and summer (March to June). The average annual rainfall of the area is about 1200 mm. maximum temperature reaches to 44° during summer and minimum 5° c during the winter season. In Udanti wildlife sanctuary, elevation of the area is 350 m above mean sea level (MSL). Four types of terrain conditions have been recognized i.e. plain (6%), moderate slopes (42%), steep slopes (51.7%) and plateau (3%) (Mishra, 2001).

MATERIAL AND METHODS

The study period lasted over a period of three years from 1998 to 2002. The animals spent more time in dense forest particularly during the daytime. Most of the observations were made directly from the temporary *Machans* (observation towers) which were erected on trees. *Machans* for observation were constructed at selected places near the drinking, feeding and resting places of wild buffalo. Some observations were also made from watch towers (made by forest department for tourists), near water holes (mostly ponds). The animals were observed with the help of 7X50 and 20 X50 binoculars. Most of the observations were made moving freely on foot and observed the grazing/browsing activity of wild buffalo. Auto vehicles were also used from time to time for visiting different places. The

major part of study was done by direct observations. All possible areas of the wild buffalo habitat (home range) in the sanctuary were surveyed. Several herds of wild buffalo were observed in various forest beats in the sanctuary.

HABITAT OF WILD BUFFALO

The habitat of wild buffalo in the sanctuary was worked out through remote sensing data and field observations. Six forest beats comprising 26 forest compartments are quite favorable habitat for wild buffalo, which forms an area of about 63.77 sq. km. Data concerning their locations, vegetation types and total home range was recorded to assess the nature of the habitat of wild buffalo, special emphasis was given to a particular habitat where the animal was found grazing or resting during the investigation. Home range was mostly around permanent water holes particularly where there is none or less biotic disturbance. Some (4) ponds retain water during summer and therefore, wild buffaloes mostly remain around them and in such situation the shape is circular. The Raipur to Deobhog state highway made the home range boundary in northeast side. Gudena waterfall (in Udanti river) on southern side and Taurenga village (East Raipur Forest Division) on western side of the sanctuary. The animals do cross this road, particularly in the season of paddy crop but not frequently. The Amad, Deojhar Amli, Nagesh, Karlajha, Jugar and Sahbin Kachhar forest beats make the habitat of wild buffalo. The details are depicted in table 1.

In the summer season, wild buffaloes move to other areas in search of food, water

and shelter. The decimating factor like forest fires, poor availability of fodder, cattle grazing etc. force the animals to change the home range. There are very little changes in home range during rainy season because lot of fodder

and water is available in almost entire area. in Udanti wildlife sanctuary there are limited numbers of animals and therefore, not much seasonal changes take place in the home range.

Table 1 : Habitate of wild buffolo in Udanti Sanctuary

Sl. No.	Name of the forest beats	Compartment numbers	Total area in Ha.
1	Nagesh	34, 37, 38, 39	1127.6
2	Karlajhar	43, 44, 45, 46, 50, 51	1349.95
3	Sahbin	54, 60	629.212
4	Amar	73	223.325
5	Jagad	79, 80, 81, 83, 84, 85	1448.774
6	Deojhar Amli	61, 68, 69, 70, 71, 72, 82	1599.074
Total			6477.935

The Deojhar Amli and Jugad forest beats have larger areas (1599.074 and 1448.77 Ha. respectively), having good forest with patches of grassland intermittent with forest cover. There are some perennial ponds and streams in this area, which are main water sources for wild buffaloes, particularly during summer season. The Karlajhar forest beat makes a very good habitat because it has dense Sal (*Shorea robusta*) forest on the bank of Udanti river, while Sahbin and Amar forest beats come under suitable habitat category.

HABIT

Determination of food habits

Food habits were determined by direct observations of fodder plants and grasses that were consumed by wild buffaloes in the area. All those species were identified and recorded. Unidentified species, sample were collected for confirmation by taxonomist, department of life science, university of Raipur (Chhattisgarh) and Indian Institute of Forest

Management, Bhopal (M.P.)

Grazing/Browsing

Wild buffalo preferred moist area with patches of grass under the cover of dense forest. Mostly they concentrate in tall grass patches situated near water holes (Ponds/streams/river). Although, good fodder and cover are available for wild buffalo in the sanctuary but biotic disturbance is main decimating factor that effected diurnal activity pattern of animals. The wild buffaloes are voracious grazer and browser. The fodder of wild buffalo mainly consists of grasses. However, they also feed on the leaves of shrubs and trees. The peak grazing time of animals was recorded in mid night during summer and early morning during winter and rainy season. Almost entire day of grazing was recorded during rainy season. During rainfall animals frequently graze and browse in the night while rest in the shade of trees and muddy nullah. During daytime, they graze under the canopy of forest.

Food selection of wild buffalo

It appears that buffaloes prefer variety of plants and grasses as food. There are patches of dense grasses in the sanctuary. The animal preferred grasses, legumes and young coppices of tree species. Some grasses occur on large scale on the bank of water holes. Abundant grass and other fodder are available in the sanctuary during rainy and winter season. Most of the annual herbs get dried thereby reducing the fodder availability during summer season. Forest fire burn most of the sanctuary area, when buffaloes browse on the leaves of trees and shrubs. It was observed that animals were frequently browsing on the saplings during summer season, while few browsings recorded during winter and rainy season since sufficient grass was available.

Types of food plants eaten

During rainy season a variety of grasses occur in good quantity so animals avoid browsing while during winter, they prefer grazing and browsing both because availability of grasses is much less than the rainy season. The leguminous species such as *Desmodium*, *Flemingia*, *Indigofera* occur in the area. Many species of forbs (herbaceous species other than grasses and legumes) also occur in the sanctuary area. It was observed that some animals were frequently browsing on the saplings of *Shorea robusta*, *Pterocarpus marsupium*, *Bridelia retusa* etc. Ranjitsinh(1997) studied that the wild buffaloes of Kaziranga National Park prefer to graze in short grass areas when the shoots are young and green. This implies small mouth full of food with a slow but continuous progression and

consequently a long period of grazing.

Grasses as food

A large variety of grasses occur in sanctuary mostly during rainy season. The common grasses are *Heteropogon contortus*, *Themeda triandra*, *Imperata sp.*, *Saccharum sp.* and *Bothriochloa sp.* etc. which are grazed by wild buffaloes. *Heteropogon contortus* and *Saccharum spontaneum* make good combination, which the animals prefer. Grass species like *Heteropogon contortus* is commonly available in the sanctuary area as well as agriculture bunds near habitation but wild buffalo prefers only premature plants, The mature shoots of *Heteropogon contortus* having awns are generally avoided by wild buffalo because the grass have spear like structure which can pierce through the intestinal walls and thus cause internal injuries. This is the natural tendency among the wild animals to avoid injurious things. Some animals fed on the dry grass species like *Heteropogon contortus* (when the spiny awns are shed) in mid June of 1999. By the onset of rains some perennial species of grasses sprout and become green and suitable for grazing by animals (Kotwal & Mishra, 2003).

The *Imperata cylindrica* are much preferred by wild buffalo as fodder during all the three seasons, particularly cold and dry season while *Bothriochloa species* is much preferred during cold season. The patchy distribution of *Cynodon dactylon* in the sanctuary is much preferred by animals during summer season. During winter season favorable crop *Dolichos biflorus*, *Brassica campestris* and *Phaseolus radiatus* come in the sanctuary.

The details are depicted in table 2.

Shrubs/ Trees as fodder for wild buffalo

After fire during summer, the animals frequently browse on the leaves of trees species. It was observed the female animals are much active in browsing than the male animals, while adults were browsing on the soft leaves of saplings. It was observed that the wild buffaloes much preferred browsing leaves of *Oojenia*

ojenensis during cold & dry season, while *Bridelia retusa* and *Shorea robusta* are much preferred during dry season. *Indigofera cassioides* is important species which is much preferred for browsing by animals during summer season. It was observed that soft leaves of other tree species are also browsed by animals, particularly during summer. The detail are depicted in table 3.

Table2: Grasses/Forbs/crops preferred as food by wild buffalo in different seasons in Udanti wild life sanctuary

Sl. No.	Name of species	Cold season	Dry season	Rainy season
1	<i>Apluda mutica</i>	++	+	-
2	<i>Bothrichloa odorata</i>	+++ ₋	++	++
3	<i>Cyperus spl</i>	++	++	+
4	<i>Imperata cylindrca</i>	+++ ₋	+++ ₋	+++
5	<i>Saccharum munja</i>	++	++	-
6	<i>Saccharum spontaneum</i>	+	++	-
7	<i>Thameda trandra</i>	++	++	++
8	<i>Cynodon dectylon</i>	+	+++ ₋	-
9	<i>Eragrostis tenella</i>	++	++	+
10	<i>Panicum notatum</i>	++	-	+++
11	<i>Digitaria granularis</i>	++	++	++
12	<i>Heteropogon contortus</i>	+++	+	+++
13	<i>Cenchrus sp</i>	+	++	+
Forbes				
14	<i>Phonix acaulis</i>	-	+	-
15	<i>Justicia suffruticosa</i>	++	++	+
16	<i>Achyranthes aspera</i>	+	++	+
17	<i>Alysicarpus sp.</i>	++	+	+
CROPS				
18	<i>Dolichos biflorus</i>	+++ ₋	-	-
19	<i>Brassica campestris</i>	+++ ₋	-	-
20	<i>Phaseolus radiatus</i>	+++ ₋	-	-

Table 3: Shrubs/ Trees preferred as food by wild buffalo in different seasons in Udanti wild life sanctuary.

Sl. No.	Name of species	Cold Season	Dry Season	Rainy Season
1	<i>Grewia telaefolia</i>	+	++	-
2	<i>Shorea rubusta</i>	++	+++	-
3	<i>Pterocarpus marsupium</i>	++	++	+
4	<i>Semicarpus anacardium</i>	+	+	-
5	<i>Bridelia retusa</i>	++	+++	+
6	<i>Cassia fistula</i>	++	++	+
7	<i>Terminalia tomentosa</i>	+	-	-
8	<i>Oujenia oojenensis</i>	++	+++	+
9	<i>Emblica officinalis</i>	+	+	-
10	<i>Indigofera cassioides</i>	++	+++	+
11	<i>Anogeissus latifolia</i>	+	++	-
12	<i>Schleichera oleosa</i>	-	+	-

Indexes : Very High +++-, High ++, Medium ++, Low +, Not or very low -

Food and feeding habit

The wild buffaloes are largely grazers but are capable of eating a wide range of herbs and shrubs as well. They mainly feed on grasses and browse the new shoots of trees species. They also feed on some aquatic plants whenever they visit ponds and rivers. They prefer to feed on new shoots of the grasses, which have nutrition value. There are lot of grasses inside the sanctuary, on which wild buffalos feed through out the year but *Heteropogon contortus* is very common. The other grasses which wild buffalo feeds are *Saccharum spontaneum*, *Imperata cylindrica*, *Apluda mutica*, *Thameda triandra*, *Bothrichloa odorata*, *Panicum antidotale*, *Digitaria* species etc. It was observed that a herd of wild buffaloes was browsing on coppices and tender leaves of trees species as *Pterocarpus marsupium*, *Shorea robusta*, *Bridelia retusa*, *Cassia*

fistula, *Emblica officinalis*, *Dendrocalamus strictus* in the Deojhar Amli forest beat. They occasionally feed on premature fruits of some wild plants like *Cassia fistula*, *Aegle marmelos*, *Emblica officinalis*, *Bridelia retusa*, *Semicarpus anacardium* and mature fruits of *Phoenix acaulis*. There is some degree of variation in the vegetation due to change in seasonal climatic factors and this results in variation in food preference of the wild buffalo. During early parts of winter, only coarse grasses are available and animals only browse on them. They also preferred to graze on leguminous plants, which are present along with grasses. **Daniel & Grubh** (1996) studied, the wild buffalo feed on half burnt shoots of *Saccharum spontaneum* and *Heteropogon contortus* during summer season.

The grasses start drying and the animals feed on them during summer season. Animals were seen browsing on new coppices and pre

mature leaves of few plants when most of the grazing grounds were flooded and grass became dirty due to soil during rainy season. Generally animals feed on cultivated crops in growing stage when new shoots are available and also when flowering and fruiting take place.

The animals prefer green grass when available but otherwise coarse dry grasses and large variety of forbs and leaves are also eaten. There are no regular grassland in the sanctuary but dense tall grasses are available on the bank of seasonal nullahs and *jhirias*. They browse on various forbs, leaves and new shoots of tree species during cold season. The wild buffaloes were seen browsing on saplings and fleshy leaves of tree species in the plain area. They may be seen bending the stem aside by sweep of the neck or walking on it and pushing down with the weight of its body. Sometimes by biting the stem and snapping it with a twist of the head.

Conclusion :

The Udanti wildlife sanctuary is best potential

habitat for Indian wild buffalo in central India. The habitat of wild buffalo has gradually been reduced due to lot of biotic disturbances. There are four villages situated in the habitat and therefore, lot of biotic disturbances are faced by the animals. About 2000 domestic livestock are totally dependant on the habitat area, therefore diurnal activity of animals is directly effected. More than 50% forest area of the sanctuary is burnt by forest fires during the month of March to June every year. Wild buffalo preferred grazing on grass but many new coppices of trees are also fed upon by animals particularly during dry season. *Imperata cylenderica*, *Bothricholoea spe.*, *Cynodon dactylon*, *Heteropogon contortus* are important grasses which are much liked by wild buffalo. *Shorea robusta*, *Bridelia retusa*, *Ougenia ojenensis* and *Indigofera cassioides* are important tree species preferred for browsing by wild buffalo. If appropriate steps for conservation are not immediately taken then the species is likely to become extinct from this sanctuary.

Acknowledgement

I am grateful to Dr. P.C. Kotwal, Associate professor, Indian Institute of Forest Management (IIFM), Bhopal, for encouragement for this study. I am thankful to forest department of Chhattisgarh and staff of sanctuary for field co-operation during study.

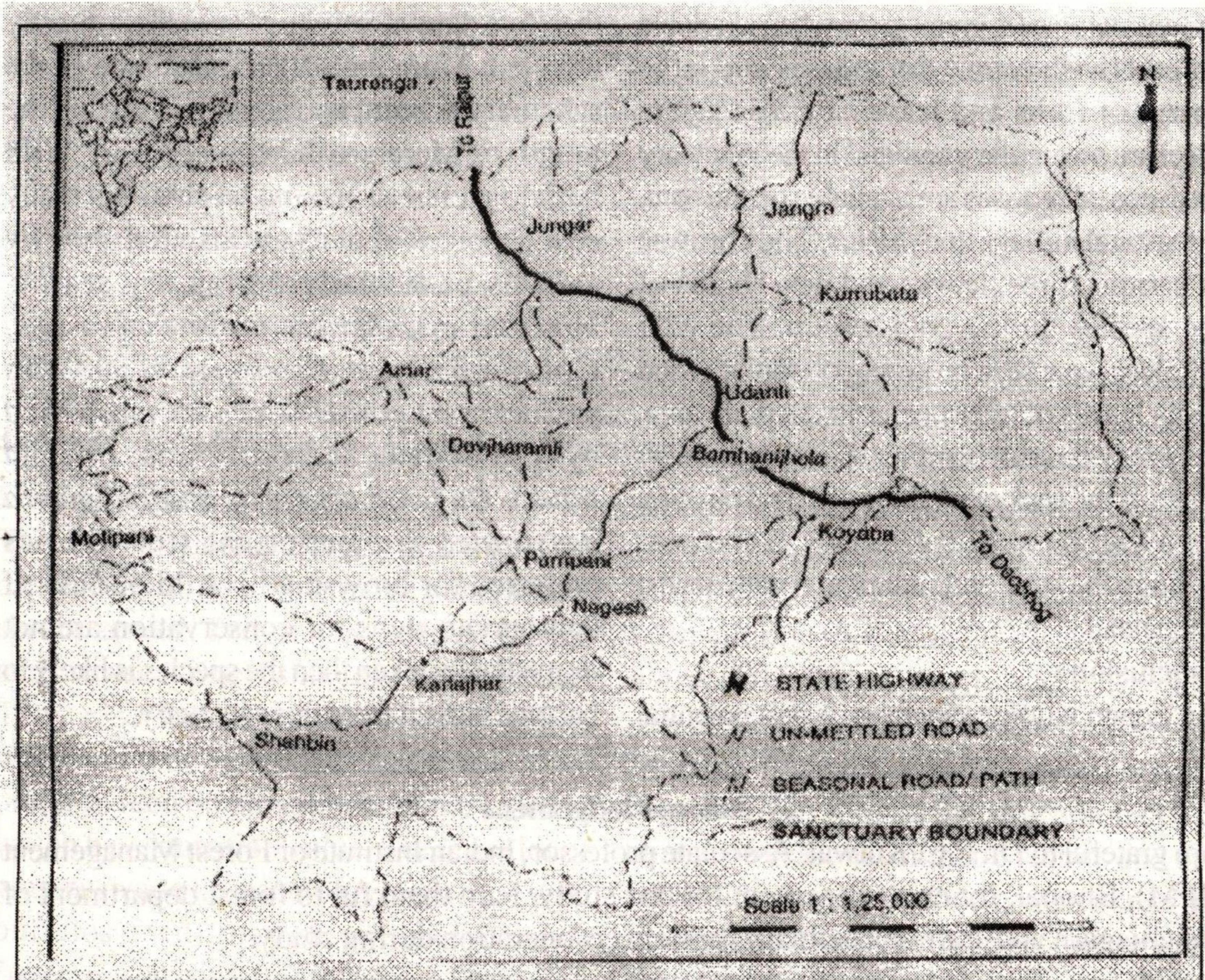
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Location map of Udanti wildlife sanctuary



Ecology and socio-behaviour of Blackbuck (*Antilope cervicapra*) in Thar Desert

By

Anil Kumar Chhangani

Introduction

Out of six species of antelope found in India, three of them exist in the Great Indian Desert, which includes Blackbuck or the Indian antelope (*Antilope cervicapra* *linnaeus*), the Chinkara or the Indian gazelle (*Gazelle bennetti* *sykes*) and the Nilgai or the Blue bull (*Boselaphus tragocamelus* *pollas*). Of these three antelopes of the Thar desert, blackbuck and chinkara belongs to sub family Antilopinae and nilgai belongs to Bovinae.

The blackbuck is essentially a species of open habitats like semi-desert, grasslands, farmlands and savannas. In the Thar desert it is well adapted for survival in arid and semi-arid regions, in particular the Orans, Gauchars and waste lands and farmlands. Blackbucks of Thar face scarcity of food during droughts and physical condition of the desert habitats. With this they are also facing food compaction with domestic livestock. In western Rajasthan the region of this animal extends from Sri Ganganagar district in the north to Barmer and Jalore districts in the southwestern part of the state (Bohra et. al. 1992).

Characteristics

A well-grown buck stands about 80 cm. at the shoulder and on the average weigh

about 40 kg. Its body measures 100-130 cm. and the tail is 14-17 cm long (Prater 1971). Its striking colour and its beautiful spiraled horns, which may reach the shoulder height of the animal, give it an elegance hardly equalled by an antelope. Horns of a fully grown adult buck, in Guda Bishnoi area near Jodhpur, measured 55.4 cm (Spirals 4, rings 54) (Bohra, et.al, 1992). Females with horns are seen rarely. The adult male is more striking in colour than female; the male is dark brown or almost black on its upper parts, with the white around eyes and on its underside. The female is fawn coloured. According to Mungall (1978) the dark colouration is a secondary sexual characteristic in the male blackbuck and is responsible for major sexual and aggressive displays. Castrated buck do not turn dark, grow robust horns, show full development of pretrial glands or gain the thick neck characteristic of normal adult males (Mungall 1978). Albinos in blackbuck, with white colour and pink-tinged eyes and horns are rarely seen.

Behaviour

Ownership of the territory pass on from one male to another stronger adult male every year or a strong male may be retaining the territory for several years. Blackbucks have

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moderate hearing sense, but have a keen sight and high speed. It show its ability of fast running especially when alarmed. It has a remarkable leaping power. It can easily jump over a 4 feet high fence by "slotting" (Bohra, et.al, 1992).

The male blackbuck normally marks the territory with defecation and urination. Males also rub their infra orbital glands secretion, from just below the eyes, on bushes and grasses for territory marking. The territorial behaviour of male intensifies during reproductive periods or for group leadership.

If a group of blackbuck is alarmed by the presence of any predator or a human hunter, the entire group will bunch up and flight together. When alarmed by one of the group members he leaps up to six feet into the air and other members soon emulate him.

Group organization

The blackbuck population can be categorised in three groups (i) "Solitary male", mostly scattered lonely, usually they are the ousted residents of "harem herds" (ii) "harem herds" with single potential resident male with several adult and young-adult females including young male individuals, and fawns of both the sexes (iii) "Bachelor herds" all male group comprising young and adult males along with some mature bucks, which have lost leadership fights or completed leadership of harem herds can also join the "bachelor herds".

Reproduction

The winner male of territorial fight stands in a suitable territory waiting for the females to come for reproduction. When the females arrive in his territory, he tries to herd them and keep them within his patch of land. Now the established resident male starts his

"head up" or "nose up" display. The male buck then struts about with a peculiar mincing gait, uttering short challenging grunts, with its head thrown upwards and courts female. Though the blackbuck breeds through out the year, but the main mating season is between February and April. After 170 to 180 days pregnancy female gives birth, mother usually conceals the newborn fawns in the grass or in the crop fields. Female usually gives birth to a single young, but twins are also not uncommon.

Food and feeding

After leaving the night resting site herd moves to foraging grounds after a stay for a while to undertake the social activities. Animals are usually more active in the morning and evening and less in the afternoon. In general the diurnal activities consist of feeding, resting and vigilance. Peak feeding is observed during morning (7.00 to 10.00 am) and in the evening (4.00 to 7.00 pm). The blackbuck usually drinks water twice in a day, but drinking water depends on the area, vegetation and seasons of different habitats.

More then 60% of the herds were found concentrated around cultivated fields during the crop season (in monsoon), which might be due to availability of variety of cultivated plant species such as *Pennisetum americanum* (Bajara), *Phaseolus radiatus* (Moong), *Vigna aconitifolia* (Moth), *Sesamum indicum* (Til), *Cyamopsis tetragonoloba* (Gwar). In summer and winter they feed on a variety of natural plants and grasses available in the home range namely *Cynodon dactylon* (Dhob), *Prosopis cineraria* (Khajari), *Prosopis juliflora* (Angraji Babool), *Tecomella undulata* (Rohira) *Capparis*

deciduas (Ker), *Acasia nilotica* (Kumbta), *Zizyphus nummularia* (Bordi).

Conclusion

1. Habaitat destruction and gradual encroachment in the preferred habitat by man and his domestic animals is one of the major causes of blackbuck population decline.

2. Transmission of domestic livestock diseases to wild antelope is also a potential threat to this endemic species.

3. Road development programs in desert area, inviting the human habitation to spread fast and wide, also facilitated killing of blackbucks in road accidents by vehicles.

Acknowledgments

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Two Male Black buck resting under the Khajari tree shadow.
(Photo: Dr. A.K. Chhangani)

THE TIGER TALE ; DARRAH WILDLIFE SANCTUARY. (DWLS) KOTA.

by : K. Chanchal Singh*

Member INTACH, KOTA CHAPTER.

After over a decade a TIGER now called the "DARRAH TIGER" suddenly made his appearance felt in the devastated and much disturbed DWLS in early May 2003. Pug marks were detected for the first time near Kolipura-Girdharpura area in the western sector of DWLS. This News caused a stir among the big wigs of the forest department. It was like a wake-up-call from the tiger "Look I am here, not yet quite extinct from my favourite haven."

A chain reaction was created by this news. The foresters suddenly woke up to investigate the report and to ascertain whether or not there was an element of truth in it. Experts went to the scene of the pug-marks armed with necessary equipment to take plaster cast, if it indeed were the pug-marks of a tiger. The media got alerted. The news spread like a wild forest fire. All and sundry joined the party. It appeared that the animal that left its trail was now haunted. Some vigil was kept on its movements. I am writing this to make a point : This unwanted human activity only created chaos.

The visiting tiger made its first reported kill of a male Blue bull (Nilgai). On inspection it was found that the remains of the kill were swiftly taken away by scavengers. Not jackals, or hyenas or the leopard but the tribals living in the forest. The tiger never had a second feed and he moved on to kill another, a cattle this

time and thereafter.

What I am trying to emphasize is that human activity factor was already at play. Tiger does not appreciate this kind of disturbance particularly at the kill. The tigers of Ranthombore are an exception. In all subsequent kills the tiger only fed on the day the kill was made. He never returned. He was already apprehensive of human activity following his movements. Obviously he was watching discreetly what these gentlemen of the forest had in the back of their mind... (Removing him to Ghana, may be.)

I had requested the foresters to tie a few baits to localise the animal's movement and watch. This was not done. However, reports of kills kept on coming. But all this while nobody had actually seen the tiger. The tigers tell-tail of pugmarks found at different locations was the only proof of its existence. It was not a ghost or an evil spirit the forest tribals generally talk about or believe in. This was a lonely TIGER roaming around in the western sector of DWLS for over two months. In spite of lack of prey base i.e., Cheetal, Sambhar or wild boar, he was quite happy killing cattle and feeding on them. Obviously cattle are in good supply to supplement its diet. This also indicate how well our sanctuaries are protected from outside interference ? This means grazing is very rampant, wood cutting is to be seen to be believed and mining activity goes on unabated!!

* Kunadi garh, P.O. Kunadi, Kota

However, one fine morning the Deputy Wildlife Conservator phoned me to say "The Darrah Tiger was no more". He had been supposedly knocked down by an Express train in Darrah in the early hours of the morning. He informed me that search and recovery forest party had been despatched to Darrah to investigate and recover the tiger body.

I offered my services and proceeded in my car along with the foresters. Other staff and keen wildlifers followed.

It was a cloudy day and was raining intermittently. On reaching the site at about 11.30 AM we saw the Tiger spread-eagled on a railway trolley and a bunch of people taking him to the railway station a few km away, up-hill.

This was the end of Darrah Tiger witnessed and sealed.

The mystery surrounds the DEATH of DARA-TIGER !!

There are conflicting reports

a : The tiger while trying to escape from the on-coming train, jumped and crashed his head against the escarpment wall. Was rendered unconscious fell into the drain next to the track.

b : The Tiger was hit by the train and was knocked off the track by the impact and fell into the drain running along the escarpment wall and died thereafter.

Both these reports are indeed plausible and acceptable with a pinch of salt. The dead tiger was removed to Kota zoo and a veterinary surgeon carried out the post-mortem. A fractured left side of the skull was detected. No other broken bones were found. The legs and spinal cord had no damage. Body scars were seen but there was nothing of

serious consequences.

None of these injuries can cause tiger's IMMOBILITY. Not even the fractured skull.

Therefore, the question is how did he DIE ?

I am seriously of the opinion that some foul play was the cause of his death.. A case of poison is very likely and a post mortem report alone can reveal it. But in the past we have had sad experience where three Great Indian Bustards in Sorsan had died of taking toxic-poison feed. Negative reports were received. I have no faith in these vets.

Therefore, could it be possible that the tiger committed suicide ?

Animals and birds are known to commit suicide collectively or individually. But these are rare cases and not totally proved by scientist or naturalists.

Assuming our Dara Tiger did commit suicide, then it is obvious he was knocked down by a locomotive. I have never heard of a tiger being destroyed in such a fashion. We have heard of elephants getting killed by locomotives in Rajaji sanctuary in Dehra dun and reports of elephants dying in similar fashion often come from W.Bengal and Jharkand areas due to logistic reasons. They don't commit suicide. Cheetals and Sambhars also get knocked down by locomotives due to their herd instinct. They don't commit suicide. Both these case scenarios do not apply to Dara tiger. It is funny that our Dara tiger was first one to die by either being knocked down by a locomotive or he committed suicide. I would indeed be happy if our eminent naturalists and the acknowledged Tiger Wallas could enlighten me on the subject of Dara tiger's sad demise.

I feel this a very unique death case. It would be worth while to erect Grave yard in

memory of this Dara tiger at the spot he died.

“The king is Dead, Long Live the King”

I hope we will soon have another tiger in Darrah. We must be prepared to receive him and provide greater security and freedom to flourish and expand.

This unfortunate incidence of the death of Dara tiger should not water down our enthusiasm and interest in having RAJIV GANDHI NATIONAL PARK in Kota declared soon. The potential both logistically and ecologically are great provided the Will and Wisdom of our political friends and bureaucrats is there. It can be done, but both are equally dishonest and ignorant regarding the importance of our forests. Wildlife and ecosystems are so essential for our survival and the very survival of this Planet. The tiger plays a very important role in the psyche of this country.

Tiger is a remarkably resilient animal. Those who had professed its extinction in the wilds by 2000 have proved wrong. But there is very little to rejoice about. The threat of extinction is indeed very omnipotent. The number of tigers recorded LIVE in the wild in this vast tiger country is shockingly low at around 3600 in 2002. This figure too is doubtful. Ranthombore and Siriska proudly claim about 40 and 32 tigers each. A grossly inflated figure. The technique and system adopted for tiger census is so obsolete that itself cast a shadow of doubts. The forest staff involved in this task are basically untrained. This draw back is not applicable to Rajasthan alone but most of the Wildlife sanctuaries suffer with the same malaise. Hence the overall position of the tiger remains quite critical. Man and animal conflicts affect all our sanctuaries

and Wildlife Parks.

Tiger is the epicentre or the King-pin in maintaining the balance of Nature. If the tiger is wiped out, as has happened in some eastern countries, consequences will be extremely grim. On the other hand if tiger population is permitted to increase and expand N. Parks & W.L. Sanctuaries will be better off and persons who are deliberately destroying these animals be economically happier. Dunbar Brander, one of great authority on tigers in India says and I quote.. “Although tigers do a great deal of damage they have their uses in preserving the balance of nature.” and he says further and I quote “There is an outlying patch of forest in Hoshangabad district which always contained a few tigers when I was there in 1907. Some years later they were all shot out and the forest being isolated no others (tiger) wandered in. I visited this tract again in 1917 and the surrounded villages were simply over run with pigs and nilgai. Many fields had gone out of cultivation.” Unquote. A food for thought !!

Elsewhere Dunbar Brander wrote that the tiger population was estimated to over 40 thousand tigers in 1920-30. It is also reported in one of the chapters of Anthology of Indian Wildlife that over 100 were annually shot in Rajasthan.

Something to think about ? Our forest land area has not shrunk, only the forest cover has disappeared and mining, grazing and other activities combined with total mismanagement has created a situation verging on calamity. No wonder we are faced with droughts year in and year after followed by famine and chaos.

Dara tiger is NO MORE. He cannot be resurrected. But surely we can translocate tigers from our other Tiger Parks.

VULTURE SIGHTINGS AT BAGDARA SANCTUARY

SIDHI (MADHYA PRADESH), INDIA

Dr Ram Bir Singh Kushwah

Abstract

The thirty-four birds belonging to six species of the critically endangered species of vulture have been observed together in the Jagmar Beat of the Game Range Bagdara in Sidhi district of Madhya Pradesh. This was an important observation in the context of the present vulture crisis.

Introduction - The vulture crisis & its cause

A vulture is a large bird that eats the flesh of dead animals. So they play an important role in the cleaning of our environment. The species (of genus 'Gyps') have moved to the IUCN threat list and Red data Book and categorized as **Critically Endangered Species** category. Prakash (1999a), Chauhan (2001), Padate et al (2001), Chhangani et al (2002), Khanna et al (2003); and many other scientists and naturalists have reported the declining population of vultures in India and abroad during the last decade. It is a matter of serious concern.. Due to this, the carcass of the cattle, domestic and wild animals have been seen at many places lying undecomposed for many days (Khanna & Uniyal 2001).

There are eight species of vultures known in India (Khanna et al 2003, Khanna & Uniyal 2001). These are:

Bearded vulture	Gyptaens burbetus
Cineros vulture	Aegypius monachus
Egyptian vulture	Neophron pernopterus
Himalayan Griffon vulture	Gyps himalayansis
Indian Griffon vulture	Gyps fulvus
King vulture	Sarcogypus calvus

Long-billed vulture

Gyps indicus

White-backed vulture

Gyps bengalensis

Vultures feed on the carcasses or the kills of the carnivores. They are commonly sighted usually near slaughterhouses and waste disposal grounds. They are most crucial avian scavengers playing an important role in monitoring the health and beauty of the environment. The exact cause of the decline in the vulture population is not known. The several account of mortality reported by naturalists and scientists due to the epidemic of adenovirus disease and also by the head drooping syndrome (HDS) (Prakash 1999b Ahmed 2000, Sebastian 2000, Dalme 2002, Khanna et. al 2003). The adeno-virus is a type of DNA virus' found in animals and human beings as well. Earliar these vultures were hated by the general public, but now have become obsessions of the conservationists. Khanna and Uniyal (2001) listed some threat causes in the declining population of vulture and also discussed conservation measures.

The villagers feed their cattle on chemically treated Linseed (Alsi), which is

believed by the villagers to be good for higher yield of milk. But the chemical contents of Als, which is passed on indirectly to the vultures through the dead livestock, are toxic and cause mortality in vultures. The pesticides like DDT, Dieldrin and Aldrin are used extensively in India. The pesticides can have a tremendous impact on bird population.

Therefore, excessive use of chemicals as farm manure and excessive use of insecticides and pesticides on crops may also be the causes of decline of vulture population. The pesticides and insecticides are highly bio-accumulative and can make egg shells thin, leading to death of embryo and breeding failure among raptors like vulture, which are slow breeders (Ahmed 2000). Khanna & Uniyal (2001) opined that Adino-virus causes head drooping in vultures (Head drooping Syndrome or HDS) that is reported as one of the causes for large-scale death in vultures.

The recent Observations in other Areas

The Observations of the vulture species by other scientists: Thirty-five birds pertaining to six species at village Budhi in the outskirts of DehraDun were observed by Khanna et al (2003). The species observed were White backed vulture (*Gyps bengalensis*), Indian Long-billed vulture (*Gyps fulvus*), Egyptian vulture (*Neophron pernopterus*), King vulture (*Sarcogypus calvus*), Cinerous vulture (*Aegypius monachus*). Similar observation were made near Rajaji NP at Kotdwar (District Pauri Garhwal) by Khanna et al (2003). Also, the vulture observations were reported in Rajaji NP by Rao (2001), Vishnu Prakash (of BNHS) in Keoladeo Ghana NP and Sharma et al (2003), etc and by many other scientists.

The Observations in Bagdara Wildlife sanctuary of Madhya Pradesh

The Area

The Bagdara sanctuary is one of the finest sanctuaries of India due to its unique features, nestled in the 'Kaimur hills' located in the Sidhi district of Madhya Pradesh. Here there are so many attractions for the; tourists, viz., four natural caves and cave shelters (Dhaulagiri, Gora Pahari, Mughalmara and Rani Machi) with rock-paintings done by the pre-historic man. the landscaping, the water falls (Singhvi water fall, etc.) and the rich biodiversity (Kushwah 2002). The floral and faunal biodiversity indices computed for the sanctuary are 0.9366 and 0.8670 respectively (Kushwah & Verma 2002). The sanctuary has an immense potential for eco-tourism (Kushwah 2002a). As the tourist enters the sanctuary, he has full confidence in his mind that he will go back home after sighting herds of wild animals, specially the species like black buck (*Antelope carvicarpa*), nilgai (*Boselaphus trangocamelus*), chinkara (*Gazella benneti*), sambhar (*Cervus uicolor*), etc. together with other wild animals. More than hundred species of birds are also resident to the sanctuary along with some visitors (Kushwah 2002a).

The details of the vulture observation in the Bagdara sanctuary have been summarized in Table-1. The author along with the Director Sanjay NP Sidhi and the staff of the sanctuary toured and explored the sanctuary several times during the year 2002-2003. While moving in the Jagmar Beat of the sanctuary in the month of February 2003, we saw many vultures at one place. Curiously, we went nearer and observed the birds with some

distance keeping our vehicle (Gypsy) away. We stayed there for about two to three hours. After one week of the previous observations, the four species (total twenty-five birds) were observed by the staff in the sanctuary. All the observations were reported immediately to the PCCF & CWLW of Madhya Pradesh and also to the BNHS. It was very good experience for the author, the Director SNP and the staff.

Table-1
THE VULTURE SPECIES OBSERVED
IN BAGDARA SANCTUARY SIDHI (MADHYA PRADESH) INDIA

Date of observation: February 2003

Time of Observation: 12 to 3 PM

Beat: Jagmar; Range: Game Range Bagdara;

The PA: Bagdara WL Sanctuary

Total birds: Thirty-four.

The Observers: Sri CK Patil, IFS Director Sanjay NP Sidhi (MP);

Dr RBS Kushwah, SFS Superintendent Bagdara sanctuary, Sidhi (MP)

Sri Shiv Mohan singh GRO, Sri Ramji Sharma GS, Lal Sajeewan BG

Sri Panna lal, Mrigrakshak, all from Bagdara sanctuary Sidhi (MP).

<u>COMMON NAME</u>	<u>हिन्दी नाम</u>	<u>SPECIES</u>	<u>IDENTIFICATION MARKS</u>	<u>OBSERVATION</u>
Cineros vulture	काला गिद्ध	Aegypius monachus	A massive, black or blackish brown vulture with pinkish naked neck with a black ruff. Head partially naked with crown, occiput, cheek and lores covered with fir like feathers. No fleshy wattles. Immediately distinguished by its size and colour.	Six birds were observed initially, out of which four were more active, i.e., they were flying and coming back in group.
Egyptian or white scavenger vulture or Pharaoh's Chicken	स्फेद गिद्ध	Neophron pernopterus	A dead white kite like vulture with black wing quills, and naked yellow head and bill. Immature birds brown, rather like the kite, but the wedge-shaped (not forked) tail diagnostic.	Four birds were observed. They joined the group after half an hour.

**Indian
Griffon
vulture**

भारतीय
ग्रिफोन
गिद्ध

Gyps fulvus

A huge common brown vulture, with scrawny almost naked neck. Head with yellowish white hairlike feathers and down A distinctive whitish ruff at base of neck Pinkish brown with narrow pale shaft stripes below.

Ten birds were observed six were present initially and four joined after some time.

**King
vulture**

राजगिद्ध

**Sarcogypus
calvus**

The HUGE black turkey-like vulture with deep scarlet naked head, neck and legs. In overhead flight a whitish band on underside of wings prominent, also white patches on upper thighs and at base of neck. In sailing, wings held above Plane of body in a wild V.

Six birds joined the group from very beginning. They led the group during all group activities.

**Indian long-
billed
vulture**

लम्बी चोंच वाला गिद्ध

Gyps indicus

Brown above with feathers pale edged (scalloped). Head, neck and nape naked (Himalayan race) or patchily covered with hair like feathers or down (Peninsular). A distinct white ruff at base of neck. Sanday brown below with broad pale shaft stripes. In overhead flight pale underside broad black trailing edge of underwing separates it from White backed vulture. The brown as against cinnamon of the Griffon distinguishes it from the similarly under wing marked Griffon

Six birds were present in the group. They joined together and fled away after one hour.

**White -
backed or
Bengal
vulture**

बंगाल गिद्ध

**Aegypius
monachus**

A heavy, dirty blackish brown vulture with scrawny, naked head and neck. At rest, and while banking in the air, the white back is diagnostic. In overhead flight a whitish band stretching along underside of wings, broken

Two birds were present and left the group after half an hour.

The above species of vulture could not be observed all together afterwards, but at least three to four species with 15 to 20 birds in March 2003 in the sanctuary were observed. The article has been written with the view that these observation may be of some use for the scientists to cope with the situation of vulture crisis in our country and abroad

Conclusion

The observation of the six species of vulture in the Bagdara sanctuary shows the presence of these critically endangered species in the area.

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A Survey of Bird-calls 1997-2000 at Calcutta

Prosenjit Das Gupta

Introduction

Bird-calls have long been studied by naturalists to gain direct and indirect information about the natural history of the various species of birds. Bird-calls are known to be used to advertise the occupation of a certain space or territory for feeding or breeding purposes, or as a prelude to pair-formation, to advertising breeding fitness, to indicate alarm and so on.

This study was undertaken with the idea of getting an idea about the early morning spacing of calls of the different common birds in Calcutta, getting an indication about their relative abundance or scarcity in the locality, and further, to gain information as to their seasonal migration into or out of the city with the changing seasons, their peak nesting season, etc.

Outline of Study

In this study bird-calls were recorded (totalling 8991 records) by the author in the early hours of the morning over a period extending from 1st July 1997 to 31st May 2000 in south Calcutta. The author's residence is situated in Bansdrani, a part of Tollygunge in south Calcutta (southern West Bengal). At that time, between 1997 and 2000, this was surrounded on two adjacent sides by two large disused plots of land. The first had several old mango (*Mangifera indica*) and bel trees (*Aegle marmelos*), besides a few coconut palms. The other plot, lying immediately to the north of the residence, had a number of large jilon (*Trema orientalis*) and jaggi dumur

(*Ficus hispida*) trees and again a couple of coconut palms. Nearby, only about 50 metres away to the east is another large relatively unused piece of land of about 100 metres by 100 metres, belonging to an ashram. This has a number of flowering and fruiting trees, such as mango, jamun, *Ficus* species *Spondias* species, Also nearby, say about 300 metres away to the west are two fairly large ponds.

Methodology

The author has been doing bird-watching since 1980 and is familiar with the calls of the common birds. Immediately the first bird-calls were heard in the early morning each day, the time was noted with a wrist-watch. Usually the birds called in bouts, that is all at once and again after the lapse of some time. The subsequent calls were noted at 15 minute intervals, i.e. if the first call was recorded at 4.15 am of a species calling more or less simultaneously, then the next record of the calls was made at 4.30 am, intervening calls if any within that 15 minute period being ignored. This recording went on till 8.00 am each day, other than on few occasions when the author was out of Calcutta. The different species that called simultaneously or in sequence over time were noted in a note book with the particular time interval shown against each and subsequent calls of the same species were marked thus ///. For example, Magpie robin - 0430-/, Redvented bulbul - 0445 - /, and so on.

These data, such as species of the bird, the date and time of the first call and

subsequent calls, the total number or bouts of calls recorded over the entire study period, the time at which most of the calls were made and so on were subsequently entered in a computer with Windows 95 Excel programme.

Results and Discussion

The 8991 call records between 1st April 1997 and 30th June 2000 pertained to a total of 41 species. The numbers of calls recorded and other details against each species is as Follows -

Common name of bird	Total number of calls	Frequency & time of first & second calls	main cluster of calls in (month)	Relative Local Population
1) Black-headed oriole	381	6-0445 & 6-0500	June	Good
2) Blue-throated barbet	328	3-0500 & 4-0515	May	Good
3) Crimson-breasted barbet	24	1-0445 & 7-0515	May	Low
4) Black drongo	26	1-0545 & 2-0615	December	Low
5) Black headed yellow bulbul	1 (15/7/97-6.30am)	NA	NA	Poor
6) Redvented bulbul	850	11-0430 & 54-0500	May	Abundant
7) Red-whiskered bulbul	1	NA	NA	Poor
8) Brown shrike	200	6-0500 & 10-0515	October	Good
9) Common myna	852	8-0430 & 39-0445	July	Abundant
10) Greyheaded myna	106	2-0530 & 1-0545	August	Low
11) Jungle myna	8	1-0530	March	Poor
12) Pied myna	15	3-0630	July	Poor
13) Coucal	3	1-0645	July	Poor
14) House crow	862	1-0345 & 12-0400	July	Abundant
15) House sparrow	820	6-0400 & 53-0430	May	Abundant
16) Fulvous breasted woodpecker	19	2-0600	March	Poor
17) Lesser golden backed woodpecker	220	5-0500 & 8-0515	April	Good
18) Rufous-bellid woodpecker	1 (13/02/99-7.30am)	NA	NA	Poor

19) Green bee-eater	2	2-0700	February	Poor
20) Grey wagtail	38	11-0545 & 6-0600	November	Low
21) Unidentified wagtails	4	2-0615	October	Poor
22) Indian hawk cuckoo	15	7-0530	February	Poor
23) Indian tree pie	91	1-0500 & 7-0530	August	Low
24) Jungle babbler	106	3-0530 & 17-0545	April	Low
25) Koel	654	37-0430 (1-0230)	May	Good
26) Magpie robin	761	4-0330 & 5-0345	May	Abundant
27) Pariah kite	114	9-0430	May	Low
28) Purple-rumped sunbird	237	1-0500 & 6-0515	May	Good
29) Purple sunbird	2	1-0630	January	Poor
30) Red-breasted flycatcher	34	1-0600	October	Low
31) Rose-ringed parakeet	330	1-0500	August	Good
32) Red-breasted parakeet	1	NA	NA	Poor
33) Spotted owlet	61	1-0300	August	Low
34) Spotted dove	76	1-0500	September	Low
35) Stork-billed kingfisher	32	3-0500	July	Low
36) White-breasted kingfisher	28	2-0445	June	Low
37) Tailor bird	823	1-0430 & 12-0445	July	Abundant
38) Orange-headed ground thrush	1	NA	NA	Poor
39) Palm swift	1	NA	NA	Poor
40) Unidentified warblers	43	7-0615	December	Low
41) White-rumped swallows	1	NA	June	Poor

(The common names given are as given in Salim Ali "A Pictorial Guide").

Quite a few inferences may be made from the above data. However, in brief, it would be seen from the above that

(a) The resident species like Magpie Robin, Koel, House crow, Spotted owlet, etc. are apparently more sensitive to emerging light and call earliest to advertise their feeding or occupation of a feeding area.

(b) As may be expected, the maximum number of calls for sixteen species are clustered around the breeding period of March to June, covering the pair-formation, incubation and feeding of the young;

(c) There is also a temporal spacing even amongst the resident species so that announcement of breeding fitness and feeding of one species is separated by about half an hour to one hour from the others.

(d) The clustering of calls of some other resident species such as Common myna, Indian tree pie, Rose-ringed parakeet and

Spotted dove during July to August possibly points more towards the feeding of fledglings rather than to pair-formation.

(e) The migrant (including the locally migrant) species like Red-breasted flycatcher, Brown shrike, Grey wagtail, etc. seem to call somewhat later than the resident species (possibly because their breeding is done elsewhere or at a different season).

(f) As to relative local density of population, it is notable that even in an urban environment, there were seven species that were abundant, seven relatively good; thirteen were low and fourteen that were poor. In other words on any day, it would be quite possible to see or hear fourteen to eighteen species within fifty metres of our residence.

(g) Some vagrants or escapees such as Red-breasted parakeet, Black-headed yellow bulbul were noted. Some species such as Green bee-eater, Palm swift were unexpectedly low in numbers.

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Field observation on Wildboar, an agricultural pest in the irrigated area of Indira Gandhi canal, Rajasthan.

Sanjay Madan, Prashant Bissa, Bhargava, R.N., Rajpurohit, L.S.

ABSTRACT

The wildboars occur throughout India except the desert region of Rajasthan where it has almost disappeared during recent times (Prakash & Ghosh, 1980). But now the whole situation has changed. Our observation that the wildboar which used to occur less frequently in the past is now very common in Indira Gandhi Canal region and its population is increasing. A large number of wildboars occur in and around agricultural areas throughout Indira Gandhi Canal viz Sriganganagar, Hanumangarh, Anupgarh, Bikaner, Bikampur, Nachna and Mohangarh. Crop damage by wildboar has been widely reported from each corner of the Command area of I.G. Canal. There are two main reasons for increasing number of wildboars.

(1) Availability of plenty of food around.

(2) Suitable habitat from shelter point of view.

Seepage and escape of water from the I.G. Canal has given rise to shallow lakes and swampy conditions at many places and dense vegetation has grown up which is an ideal habitat for wild boar for breeding and expanding their range of distribution. These habitats provide shelter for wildboar in day time. In night the boars move towards the crop fields near by and raid the crops severely. On the other hand a vast feeding area is available for wildboar due to the expansion of irrigated agriculture.

To assess and quantify the agricultural loss caused by wildboar is not very easy. Nor is the exact nature of damage caused by the wildboar is always known. Wildboar cause agricultural damage in a variety of ways. They do so by up-rooting, trampling, eating crops and wallowing. The nature of damage and its significance depends on many variables. The extent of damage is likely to fluctuate from place to place with seasonal condition, degree of infestation, efficacy of control measures etc.

Introduction:

The Indian subcontinent is represented by a single widely distributed genus, *Sus* with 4 subspecies. They are the domestic pig (*Sus domestica*), common wild boar (*Sus cristatus*), Andaman wildboar (*Sus andamanensis*) and Nicobar wildboar (*Sus-*

nicobaricus). The Indian wildboar (*Sus scrofa cristatus*) is a large, heavily built animal, the male averaging 36 inches (90 cm.) at shoulder height and 200 lbs (90 kg.) in weight. Whereas the female is smaller and average weight is around 65 kg. The typical feature of the boar is its elongated movable snout ending in a flat

disc like surface supporting the nostrils. The upper canines grow upwards and outwards. The wildboar being omnivorous, eats a variety of food such as roots, tubers, bulbs, fruits, insects, molluscs, carrion. (Mason, 1893; Brandes, 1923; Krishnan, 1972; Johnsingh, 1978; Prater, 1980; Tisdell, 1982; Seshadri, 1986; Ramdas, 1987). The wildboar is essentially a forest loving animal preferring to remain in shade. It prefers thick vegetation as it provides protection from predators.

Study area :

Our study area is the irrigated land on both sides of whole Indira Gandhi Canal, from beginning of canal at Masitawali (O R.D.) to the end of canal in Mohangarh (1458 R.D.). This paper is about a preliminary survey based on the observation and questionnaires from farmers and local people of different villages in this area. The crop damage by wildboars found in the following sites is very common - Nachna, Mohangarh (Jaisalmer), Bharmsar (1095 R.D.), 730 R.D., 750 R.D., 30 D.O.D.D.R. Dantor branch Tehsil. Pugal, Anupgarh border area (98 gate of B.S.F.), (Bikaner), Khakia, Hindumalkort (Indo-pak border) in Sriganganagar district Crop damage by wildboar in Hanumangarh district was found least.

Agriculture pattern in the study area :

Both Kharif and Rabi crops are grown in the study area. The common Kharif crops (grown in July-August; depending upon monsoon) are : Bajra (*Pennisetum-typhoidenum*), Jawar (*Sorghum vulgare*) maize (*zea mays*), Gwar (*Cyamopsis-tetragonoloba*), Mung (*Phaseolus aureus*), moth (*P. aconitifolious*), Till (*Sesamum-orientale*), Castor (*Ricinus communis*) and

Narma (*Gossypium sp.*) and Sugarcane (*Sacchram- officinarium*). Rabi crops (generally irrigated ones grown in Nov. and Dec.) are : Wheat (*Triticum vulgare*), Chana (*Cicer arietenum*), Sarnso (*Brassica-compestris*) and Ground Nut (*Arachis hypogea*).

Type of damage by wild boar :

Wild boars by eating and up-rooting crops cause damage to crop production which can result in severe loss to farmers having small land holdings. The crops suffer damages by wild boars walking into the crops and young plants are often trampled upon. The boar likes groundnut crop. The villagers say that the smell of groundnut crop attracts the wildboars from a distance of 20-25 Km. The group of 15-17 wildboars can destroy the groundnut crop growing over 5-6 Bighas in a single night, causing a loss of approximately Rs 50000/-. The wildboar also prefer other crops like Chana (*Cicer arietenum*), Wheat (*Triticum vulgare*), Bol of Narma (*Gossypium sp.*) and Sugarcane (*Sacchram officinarium*). In Wheat crop the wildboars chew soft upper part of mature wheat, suck the juice and throw the remains. The Cucumber and other soft vegetable crops are frequently damaged by wildboar in the study area.

Various control measures used in study area by farmer :

The efficacy of the damage control methods, by and large remained ineffective in restraining the wild boar population in the area. It was observed that the wild boar in the region showed marked intelligence in overcoming the restrains imposed by human beings to protect the crop whenever it was made possible.

Guarding of farms

The local farmers construct huts at

strategic points within and outside crop fields. The farmers move into huts to keep watch over their crop. They make noise, sing songs and beat empty tin canisters. A large log of wood is burnt in front of the hut to keep the occupants warm and to create a psychological barrier to deter the animals from entering the fields. Guarding of farms at night is most common method employed in the study area. However, the effectiveness of this method is limited and does not guarantee full protection.

Noise

The common method is to hang an empty tin canister by a pole in the field attached to the canister is a piece of thick wood. Due to blowing wind the wood strikes the canister making a noise similar to the beating of empty canisters.

Fire works

Crackers are also exploded occasionally by some farmers. Since this method is a bit expensive it is not as common as canister hung by pole. The ingenuity of this method is bursting crackers after an interval of time at night. A piece of rope is hung in the field and the crackers are tied to it with some

spacing. The loose end of the rope is burned. As the fire reaches, the cracker tied to the rope gets ignited and bursts. However, wild boars often get used to this fire work alarm after some time.

Scarecrow

Installing scarecrows is common in the area but this method is also found unsuccessful. At night and also during day time in tall grown crops the scarecrows cannot be easily noticed by the wild boar. Also the wild boar employs sense of smell to locate human and has moderate eye sight hence scarecrows are totally ineffective.

Stone throwing

Stone throwing by farm guards is also practical to keep the crop pest away. But this method is ineffective and the wildboars keep moving from one field to another. Since the crop raiders are nocturnal, visibility is a major limitation for the farm guards.

Fencing

Fencing small plots with stone walls, barbed wire is effective against wildboars to certain extent but this method is not feasible over a large area due to cost factor

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Biodiversity Conservation in Protected Areas of Uttarakhand, India

S.R. Katiyar

Biodiversity is the basis for the survival of human being as it provides all essential bio-resources such as food, shelter, cloth, medicine and other raw materials. In recent years the increase in human population has led to the over-exploitation of natural resources and cause for the extinction of a huge number of plant and animals. Thus, depletion of biodiversity is alarming problem not only in India but all over the world. In 1988, World Conservation Strategy suggest that the initial efforts of biodiversity conservation should aim at establishment and maintenance of a network of protected area system by making policy changes involving local inhabitants in the protected area management and mobilising financial resources for their conservation and protection. The protected areas (PAs) not only benefit wildlife, but indirectly human being also. Their protection means the protection of entire ecosystem which is necessary to continue to enjoy the benefits that accrue from it. The biodiversity conservation has been already initiated by the Forest Departments of Uttarakhand in the form of declaring certain areas as National Parks, Wild life Sanctuaries and Biosphere Reserves. Therefore, it is pertinent to protect & conserve the existing biodiversity in these areas for the socio-economic infrastructure development of local inhabitants and maintenance of ecological stability in the state of Uttarakhand.

Uttarakhand state is situated approximately between $28^{\circ} 42'$ to $31^{\circ} 28'$

North latitudes and $77^{\circ} 35'$ to $81^{\circ} 5'$ East longitudes, covering a geographic area of 53,483 sq. Km. The state is bound in the north by Tibet; in the west by Himachal Pradesh; in the east by Nepal and plains of Uttar Pradesh in the south. The state is quite rich in biodiversity. The richness in biodiversity is due to the immense variety of climatic and altitudinal conditions coupled with varied ecological habitats. Fortunately, the Doon Valley (Uttarakhand) is recognised as one of the Biological Sensitive Area (hot spot) in spite of biodiversity. This valley is situated between the Shivalik hills in the south and lower Himalayas in the north.

Conservation methods make a separate sub-discipline of biodiversity studies called the "**Conservation biology**". Techniques of biodiversity conservation include i) *Ex-situ* conservation and ii) *In-situ* conservation. *Ex-situ* conservation means "the conservation of components of biological diversity outside their natural habitats." Development of *Ex-situ* measures for biodiversity conservation is a compliment to *In-situ* approaches. *In-situ* conservation includes "conservation of plant and animals in their native ecosystems or even in man made ecosystem, where they naturally occur." This method of conservation is applied only to wild fauna and flora and not to the domesticated animals and plants. The main aim of biowealth conservation is the preservation of land races with wild relatives in which genetic exists and

/ or in which the weedy / wild forms present hybrids with related cultivars. *In-situ* conservation of habitats has received top priority in the World Conservation Strategy Programmes launched since 1980. In this type, conservation includes a system of protected areas of different categories e.g., National parks, Sanctuaries, National Monuments, Cultural land scapes, Biosphere Reserves, etc. The protected area is "a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives. The creation of a protected area is one of the best methods to save wild life species, which is on the road to extinction. The term 'wild life' is commonly referred to

represent the non-domesticated animals living in a natural habitat. But in its widest sense it includes all flora and fauna of the natural habitat. In fact, protected areas being home of the wild-life, they afford important aesthetic and touristic values, and also have a biological importance as gene reserve.

In the Steering Committee meeting of the Commission of National Parks and Protected Areas of IUCN (International Union for the Conservation of Nature and Natural Resources) held in 1993, a consensus of opinion was reached to have as many as six sets of categories of the protected areas, depending on broad management objectives. These are given as below:

Category	Objectives
I. <i>Strict Nature Reserves / Wilderness</i>	PAs managed mainly for science or wilderness protection.
II. <i>National Parks</i>	PAs managed mainly for ecosystem conservation and recreation.
III. <i>Natural Monuments</i>	PAs managed mainly for conservation of specific natural features.
IV. <i>Habitat / Species Management Areas</i>	PAs mainly for conservation through management intervention.
V. <i>Protected Land scape / Sea scape</i>	PAs managed mainly for land scape/sea scape conservation and recreation.
VI. <i>Managed Resource Protected Areas</i>	PAs managed mainly for the sustainable use of natural ecosystems.

PAs = Protected areas.

Category I corresponds to the sanctum sanctorum of the PAs. The National Parks falling in Category II, Category III

sometimes occur incidentally in various PAs, but very often these area may be occurring outside the conventional PAs also. The Sanctuaries that come under the Category IV

and Category V are areas primarily maintained for the protection of catchment areas of rivers, sea coasts and for recreation. The Biosphere Reserves come under Category VI. In the state of Uttaranchal, most protected areas belonging to Categories II, IV and VI, are being managed for Conservation. In National Parks, the main objective should be ecosystem conservation and recreation. However, the Sanctuaries should fall under the habitat / species management and Biosphere Reserves to be managed mainly for the sustainable use of natural ecosystems. National parks, Wild life Sanctuaries and Biosphere Reserves are different in concept and legal status, which vary from country to country and often creating confusion. The concept and functions of various reserves are discussed in this context for the purpose of clear-cut understanding of the reader and avoid confusion. These are given as below :

National Park : "A relatively large area of land set aside (under some Act) for its features of predominantly unspoiled natural landscape, flora and fauna, permanently dedicated for public enjoyment (tourist), education and inspiration as well as protected from all interference." There are about 75 National Parks in India. Of these, six National Parks are in the state of Uttaranchal. A National Park is created by an act of parliament.

Wild life Sanctuary : Similar to a National Park, "it is dedicated to protect the wildlife,

but it considers the conservation of species only and also its boundary is not limited by the state legislation. A limited amount of grazing by cattle is permitted for practical purposes taking into account the rights of the local population". At present, there are about 450 wild life sanctuaries in India, of these, six wild life sanctuaries are in Uttaranchal. After the amendment in wild life protection act 1972 sanctuaries are also created by an act of Parliament.

Biosphere Reserve : Biosphere Reserve can be defined as "an undisturbed natural area suitable for scientific study as well as area in which conditions of disturbance are under control. Reserve has been set aside for ecological research and habitat preservation." There are 17 sites proposed for biosphere reserves in India. Of these, two sites are in the state of Uttaranchal, one is the Uttarakhand and other is Nanda Devi biosphere reserve.

In fact, Uttaranchal state is rich treasure of biodiversity. It is one of the most interesting state of India with climate and vegetation varying from tropical to temperate and arctic (Table 1). The main forest types found in the state are: sal forests, chir pine forests, *Ban*, *Moru* and *Kharsu* oak forests, blue pine forests, deodar forests, fir spruce forests, sub-alpine forests and moist and dry alpine scrub. In general sense, state is the home of tiger, leopard, snow leopard, elephant, muskdeer, chital, ghoral, sambar and many other wild animals and birds.

Table 1: Climate and vegetation in Uttaranchal

Condition	Altitudinal range (meters)
Tropical	below 700
Sub-tropical	700 - 2000
Temperate	2000 - 3500
Sub-arctic	3500 - 4500
Arctic	over 4500

Source: Negi, S.S. 1992. *Himalayan Wild life : Habitat and Conservation*, Indus publ. Comp., New Delhi.

For the conservation of biodiversity in the protected areas, state Government has set-up six National Parks, six Wildlife Sanctuaries and two Biosphere Reserves (Tables 2-4), as given below:

Table 2: National Parks in Uttarakhand

No.	Name	Set-up (year)	Area(Km ²)
1.	Corbett National Park, Ramnagar, Nainital	1936	521
2.	Gangotri National Park, Uttarkashi	1989	2390
3.	Govind National Park, Uttarkashi	1990	472
4.	Nanda Devi National Park, Chamoli	1982	630
5.	Raja Ji National Park, Dehradun	1983	820
6.	Valley of Flowers National Park, Chamoli	1982	87.5
Total			4920

Source: Ganakoti, N.S. 2003. *General Knowledge of Uttarakhand*, Upkar Publ., Agra p. 24.

Table 3: Wildlife Sanctuaries in Uttarakhand

No.	Name	Set-up (year)	Area(Km ²)
1.	Askot Wildlife Sanctuary, Pithoragath	1986	600
2.	Binsar Wildlife Sanctuary, Almora	1988	46
3.	Govind Wildlife Sanctuary, Uttarkashi	1955	481
4.	Kedarnath Wildlife Sanctuary, Chamoli/Rudrapur	1972	975
5.	Mussoorie Wildlife Sanctuary, Dehradun	1993	11
6.	Sone nadi Wildlife Sanctuary, Garhwal	1987	301
Total			2414

Source: Ganakoti, N.S. 2003, *General Knowledge of Uttarakhand*, Upkar publ., Agra p. 24.

Table 4: Biosphere Reserves in Uttarakhand

No.	Name	Set-up (year)	Area(Km ²)
1.	Nanda Devi Biosphere Reserve	1988	5860.57*
2.	Uttarakhand Biosphere Reserve	Yet to be setup	3942.00**
Total			6178.74

Source: *Kumar, U. and M.J. Asija, 2000. *Biodiversity: Principles and Conservation*, Agrobios Pub., Jodhpur, p.60.

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1. Corbett National Park

This is oldest national park set up in 1936 in the foot hills of Garhwal and Kumaun. with an area of 521 sq.km including the reservoir of the Ram ganga dam. The river Ram ganga flows through this park. This park is characterised by montane and sub-montane climate where rainy season is warm and humid, winter cold and frosty nights, and summer season with hot and dry months. The forest vegetation chiefly comprises; *Shorea robusta*, *Dalbergia sissoo*, *Bombax ceiba*, *Mallotus phillippensis*, *Acacia catechu*, etc. However, the higher regions have some *Pinus roxburghii*. This park was initially known as the Hailey national park. The area of this park is an ideal habitat for tiger and a Tiger Reserve was created here in 1973

‘Project Tiger’ The project was inaugurated in Corbett NP in 1973. The Project Tiger programme has a direct impact on conservation of biodiversity. The tiger is super-predator and is at the apex of food chain, and so its growth symbolises the health of natural ecosystem.

Forest types: a) *Moist and dry sal forest*;

b) *Khair sissoo forest*;

c) *Chir pine forest and*

d) *Mixed deciduous scrub and grasslands.*

Fauna: A number of wild animals such as tiger, leopard, elephant, sloth bear, palm-civet, sambar, chital, black bear, hyena, barking deer, ghariyal, crocodiles, and many aquatic birds are protected in this park.

2. Gangotri National park

This park was setup in year 1989 and is situated around the area of Gangotri glacier (6,614 m.) of Uttarkashi district. It is spread

over an area of 2390 sq.km. The area of this park is generally marked with sculptured glaciers, horned peaks, serrated crusts and high ridges, deep valley, etc. This park supports much varied and complex physical charactersitics, mainly due to the abrupt altitudinal variations, diverse topography and climatic conditions. This park has a variety of forest species namely, *Abies webbiana*, *Betula utilis*, *Cedrus deodara*, etc. besides, xerophytic bushlands, alpine meadow and moist alpine pasture.

Fauna: Leopard, snow leopard, himalayan brown bear, muskdeer, Bharal, Himalayan tahr and some birds such as Monal are protected in this park.

3. Govind National park

This park was setup in the year 1990 and is situated in the higher Himalayas of Puroila tehsil of Uttarkashi district. It cover an area of 472 sq.km. This park has various important tree species and various type of forests. The main tree species are: *Abies pindrow*, *Cedrus deodara*, *Pinus roxburghii*, *Quercus incana*, *Q. floribunda*, *Q. semecarpifolia*, *Rhododendron sp.*, *Taxus sp.*, etc.

Fauna: Bharal, black and brown bears, leopard, snow leopard, snow partridge, muskdeer, tahr and some important bird species are protected in this park.

4. Nanda Devi National Park

This park was set up in the year 1982 and spreads over an area of 630 sq.km in the higher Himalaya for conserving flora and fauna around Nanda Devi peak and its basin.

Forest types: a) *Mixed coniferous forest including deodar*;

b) *Mixed deciduous forest*;

c) *Blue pine forest*;

d) *Sub- alpine forest and pasture.*

e) *Moist alpine scrub and pasture.*

Fauna: The Nanda Devi national park is the home of many high altitude mammals and birds including snow leopard, bharal, ghoral, Tahr serow, muskdeer, snow cock and kalij pheasant.

5. *Raja ji National Park*

Raja ji national park was set-up on 12th August, 1983, after merging the erstwhile Motichur, Chilla and Raja ji sanctuaries. This park is situated in parts of Dehra Dun, Garhwal and Haridwar districts and has an area of 820 sq.km. Population of elephants in this park was 472 (Amar Ujala, 12th August, 2003).

Forest types:

a) *Moist and dry sal forest;*

b) *Khair- sissoo or reverine forest and*

c) *Siwalik chir pine forest.*

Fauna: Tiger, leopard, elephant, sambar, chital, barking deer, Nilgai, wild boar, and many species of birds.

6. *Valley of Flowers National Park*

This park is also known as the 'Pushpawati national park' after the river flowing through the famous high altitude (3660 to 3960m) '**valley of flowers**'. This park was set up in year, 1982 in the higher Himalayas of Garhwal and has an area of 87 sq.km. Its vegetation varies widely due to diverse topography, altitude and climatic conditions. The fame of this Valley of Flowers was brought by the efforts of Smythe and Holdsworth in 1931, who were the members of the British Kamet Expedition. They collected beautiful specimens of flowering plants during their return journey through Bhyunder Valley and were so impressed with the scenic grandeur and the wealth of flora that they named it

'Valley of Flowers'. In 1937, Smythe again came to the valley for collection of the seeds and bulbs of plants for the Royal Botanical Garden Edinburgh and collected nearly 250 species, a list of which is given in his delightful book "Valley of Flowers" (1938). The occurrence of large numbers of species in the area and richness of flora has rendered the district (Chamoli) a botanical paradise.

Forest type:

a) *Sub- alpine forest and pasture;*

b) *Fir and spruce forests and*

c) *Moist alpine scrub and pasture.*

Fauna: Amongst the animals and birds found in this park are snow leopard, leopard, civet cat, tahr, serow, muskdeer, snow cock, Kalij peasant, Monal peasant etc.

1. *Askot wild life Sanctuary*

An area of 600 sq.km., ranging between 600 to 6700m, of Askot Forest Range forms the sanctuary area. The international boundary with Tibet; forms its northern limit. The river Kali in the east separates it from Nepal. The boundaries of east Almora Forest Division and Pithoragarh Forest Division constitute the western and southern limits of the sanctuary, respectively. The sanctuary is rich in medicinal plants. The local inhabitants in or around this sanctuary, utilize atleast five native Himalayan species such as *Angelica glauca*, *Allium stracheyi*, *Didymocarp pedicillata*, *pyrus vestita* and *chimonobambusa jaunsarensis*, considered sensitive due to their high rank of rarity.

Forest types: *Temperate, sub-alpine and alpine forests, typical of the Western Himalaya.*

Fauna: Snow Leopard, Leopard, Jungle cat, civet cat, musk deer, ghoral, barking deer,

brown bear, Bharal, Tahr and many species of high altitude birds.

2. Binsar Wild life Sanctuary

This sanctuary is situated in the middle Himalaya near Almora in Kumaun. It has an area of 46 sq. km. The area of this sanctuary is good for tourism. According to population record (2003), a large number of animals are living in the area of this sanctuary as given: 13 kakars, 2 bears, 57 pigs, 150 monkeys, 149 langurs and 46 ghorals (Danik Jagaran, 9th August 2003).

Forest types:

- a) *Temperate chir pine forest*
- b) Oak and mixed broad leaved species.

Fauna: This sanctuary is the home of many medium altitude species of animals and birds including leopard, civet cat, black bear and kalij pheasant.

3. Govind wild life Sanctuary

This is situated in Har-Ki-Dun valley of Uttarkashi district and has an area of 481 sq. km. The river Tons, a tributary of the Yamuna originates from higher reaches of this sanctuary. The sanctuary has altitude ranging from 3000 to 5000m. This valley is a glacial amphitheatre.

Forest types:

- a) *Temperate mixed coniferous forest;*
- b) *Temperate mixed deciduous forest;*
- c) *Fir and spruce forests;*
- d) *Sub-alpine birch, Rhododendron and juniper forests and*
- e) *Moist alpine pasture.*

Fauna: This sanctuary is the home of snow leopard, civet-cat, tahr, musk deer, snow partridge and monal.

4. Kedar nath Wild life Sanctuary

This sanctuary is situated in the upper

Mandakini valley of the higher Himalayas of Garhwal covering an area of 975 sq.km.

Forest types: *Temperate, sub-alpine and alpine forests typical of the Western Himalaya.*

Fauna: This sanctuary is the home for the endangered snow leopard, Himalayan black and brown bears, muskdeer, tahr, serow and goral. Besides, civet are also found in the area of this sanctuary.

5. Mussoorie Wildlife Sanctuary

This sanctuary was setup in year 1993 and is situated in the Dehradun district. It has an area of 11 sq.km. It's nearest bus stand in Mussoorie. Mussoorie is called "**Queen of Hills**" and has scenic beauty which attracts tourists both Indians and foreigners. The climate and vegetation of the sanctuary is temperate in nature. *Pinus roxburghii*, *Cedrus deodara*, *Quercus sp.*, *Rhododendron arboreum*, etc. are mainly found in and around this sanctuary.

Fauna: Leopard, black bear, goral, kakar, etc. are protected in the sanctuary. This sanctuary is primarily meant for protection of goral.

6. Sona nadi Wild life Sanctuary

This sanctuary is located in terai and bhabar tract of district garhwal on the west of the Corbett national park and has an area of 301 sq. km. The siwalik hills bound it in the north. The wild animals of Corbett national park and Amangarh range of Bijnor forest division generally move into this sanctuary.

Forest types:

- a) *Sal forest;*
- b) *Mixed deciduous forest and scrub*
- c) *Khair-sissoo forest.*

Fauna: Tiger, leopard, elephant, chital

sambar, hog deer, bears, ghoral etc.

Biosphere Reserves

The biosphere reserves are multipurpose areas which preserve the entire ecosystem (Plants, animals, man and micro-organisms) and its genetic diversity. It includes indigenous people, their biological resources and their associated knowledge about the biodiversity use. In 1979, 14 potential sites were identified in India for setting up Biosphere Reserves. Of these, two sites are found in the state of Uttaranchal namely, one is Nanda Devi and other Uttarakhand Biosphere reserves.

1. Nanda Devi Biosphere Reserve

This Biosphere Reserve is situated in the higher Himalaya of Garhwal and Kumaun. Nanda Devi national park and Vally of Flowers NP constituts core areas of this Biosphere Reserve. The Nanda Devi group of peaks which include the Nanda Devi, Nanda Devi East and Nanda Kot form a towering mountain wall in the north. At the base of this lies the Pindar glacier from which rises the Pindar river that joins the river Alaknanda. Valleys of this biosphere reserve have dense forests and are least disturbed. Forest Types and Flora

1. Temperate coniferous forest (*Abies sp.*, *Cedrus deodara*, *Picea smithiana*, *Pinus wallichina*, *Taxus baccata*, etc)
2. Temperate deciduous forest (*Juglans regia*, *Quercus himalayana*, *Quercus semecarpifolia*, *Rhododendron arboreum*, *Rosa macrophylla*, etc.)
3. Temperate pasture (*Dactylis glomerata*, *Themeda sp.*)
4. Alder forest (*Alnus nitida*, *populus ciliata*)
5. Sub-alpine birch/fir forest (*Abies spectabilis*, *Picea smithina*, *Betula utilis*, *Quercus sp.*,

Rhododendron companulatum, etc.)

6. Sub-alpine pasture (*Agropyron semicostatum*, *Bromous japonicus* etc.).

7. Birch *Rhododendron* scrub.

8. Deciduous alpine scrub.

9. Dwarf *Rhododendron* scrub and

10. Moist alpine pasture.

Fauna: a) Mammals (Leopard, jungle cat, wolf, brown bears)

b) Birds (Monal pheasant Kalij pheasant, wood cock, snow cock, hill pigeon, myna, Indian cuckoo etc.)

c) Reptiles (Fan throated lizard, trinket snake, etc.)

2. Uttarakhand Biosphere Reserve

Eight districts of Uttaranchal namely, Almora, Chamoli, Dehradun, Nainital, Pauri, Pithoragarh, Tehri, and Uttarkashi, (Now devided in 11 districts) constitute a region, known as 'Uttarakhand'. It is bound in the east by Nepal in the north lies Tibet. In the west is Himachal Pradesh and the plains of Uttar Pradesh are in the south. This biosphere reserve which is yet to be set up, covers an area of about 3942 sq.km., falling within parts of Almora, Chamoli, Tehri and Uttarakashi districts. The main features of this biosphere reserve are given below:

- a) Both the flora and faunal elements found in this tract represent the transition between the elements of the western and eastern Himalayas.
- b) A wide variety of forest types ranging from temperate forest at lower elevations to moist alpine pastures near the snow line are found in this biosphere reserve.
- c) The rivers Ganga and Yamuna orginate from the glaciers falling within this biosphere reserve.

d) The rock strata of this tract ranges from pre-cambrian to recent age.

e) The human dwellings, as old as 500 B. C. have been found in this area of reserve. The following forest types and flora as well as fauna occur in this biosphere reserve:-

Forest types and flora:

1. Moru oak forest (*Quercus himalayana*, *Abies pindrow*, *Betula alnoides*, *Eurya acuminata*, *Litsea umbrosa*, *Pyrus lantana*, etc.)
2. Moist deodar forest (*Cedrus deodara*, *Picea smithiana*, *Pinus wallichiana*, *Rhododendron arboreum*, etc.)
3. Temperate mixed coniferous forest (*Cedrus deodara*, *Pinus wallichiana*, *Taxus baccata*, *Quercus sp.*, etc.)
4. Temperate moist mixed deciduous forest (*Acer pictum*, *Aesculus indica*, *Juglans regia*, *Prunus cornuta*, *Rhus sp.*, etc.)
5. Kharsu oak forest (*Quercus floribunda*, *Quercus semecarpifolia*, *Betula utilis*, *Rhododendron sp.*, etc.)
6. Blue pine forest (*Cedrus deodara*, *Pinus roxburghii*, *Pinus wallichiana* etc.)
7. Subalpine high level fir forest (*Picea smithiana*, *Pinus wallichiana*, *Taxus baccata* etc.)
8. Sub-alpine birch-fir forest (*Abies spectabilis*, *Betula utilis*, *Rhododendron campanulatum*, *Sorbus foliolosa*, etc.)
9. Rhododendron scrub forest (*Betula utilis*, *Rhododendron sp.*, *Polygonum sp.*, *Viburnum nervosum*, etc.)
10. Deciduous alpine scrub (*Rhododendron sp.*, *Berberis sp.*, *Salix sp.*, *Aconitum sp.*,

etc.)

11. Dwarf Rhododendron scrub (*Rhododendron anthopogon*, *Rhododendron campanulatum*, *Sorbus foliolosa* etc.)

12. Dry alpine scrub (*Artemisia maritima*, *Eurotia ceratoides*, *Juniperus communis*, *Juniperus wallichiana*, *Saxifera imbricata*, etc.)

Fauna:

a) Mammals (Snow leopard, tahr, brown bear, black bear, Jackal, ghoral, muskdeer, barking deer, red fox, leopard cat, palm civet, Jungle cat, etc.)

b) Birds (Cheer pheasant, black kite, sparrow hawk, owl, red Jungle fowl, monal pheasant, khalij pheasant etc.)

c) (Cobra, king cobra, common house gecko, rat snake, etc.)

For the conservation of biodiversity in the protected areas of Uttaranchal, following important steps have been proposed for implementation to bring about socio-economic development of state people in future. These are given as below:

- 1) Flora and fauna co-exist complete in the forest ecosystem. They are inter-dependent and inter-related. If any one is interfered with and affected, the other is also affected. The change in composition of species in the forest ecosystem will change the human environment and affect the human life also, which some times is not noticed. It is, therefore, an urgency now to protect and conserve each species in the forest ecosystem in scientific manners;
- 2) Habitat- destruction of wildlife should be avoided or minimised as much as possible during the developmental activities.
- 3) Public should be made aware of the value

of wild life and of the factors that cause extinction of species in the protected areas. Special attention should be given to conserve the species which fall under the category of endangered, vulnerable or rare;

4) Develop and implement 'Eco-Development' projects adjacent to all the protected area in order to meet the demand of local inhabitants and also to involve them in conservation efforts of biodiversity;

5) Provide trained manpower, essential management tools, equipments, infrastructural facilities and requisite funds for insuring effective management of protected areas

6) Develop essential research programmes for the protected areas by involving local research institution, colleges and Universities, so as to develop base line data on biological and managerial parameters;

7) Establish self-sustaining monitoring system for over seeing the activities and effectiveness of protected area network in the state;

8) It is noticed that mostly attention in the protected area is focussed on conservation of large mammals. No attention is paid to conserve plants in general and lower groups of plants and animals in particular. Consequently, there are gaps in information on several biological and managerial parameters. In protected areas, biological diversity should be conserved as a matter of principle because all species deserve attention regardless of their direct use to humanity and

all of these are components of our life support system;

9) No doubt, Uttarakhand state is vast reservoir of medicinal plants, but these plants are extracted from the protected areas also for the pharmaceutical companies without the knowledge or permission of the concerned Forest Department. On urgency, this type of unwarranted exploitation of the medicinal plants should be stopped. Such pharmaceutical companies should be asked to raise nurseries of medicinal plants in near by suitable areas.

10) Wildlife Protection Act 1972 and Wildlife Protection (Amendment) Act, 1991 have not proved effective to protect wildlife with the result that hunting of wild animals is going on in most of the protected areas of the state. Wildlife Protection Acts should therefore be strictly enforced in all the protected areas.

11) People dwelling around the protected areas derive benefits from the forests- They should be persuaded and motivated for affecting conservation efforts in the protected areas. Conflict with local people should not be allowed to take place.

12) Visitors should be allowed in the protected areas with proper permission for inspirational, cultural and recreational purposes. At present, Uttarakhand Government is taking various steps to increase the number of places of tourist importance and provide adequate facilities for access, stay and recreation. The "Eco-Tourism" development is the top priority of the state as tourism can become one of the major source of income generation.

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Amorphophallus longistylus Kurz:

An endemic, rare and threatened species from Baratang Islands

Nidhi Chauhan, P.S. Roy and R.P. Jagdale

The field study under 'Jaivigyan Mission of Science and Technology' (a joint venture of Department of Space and Department of Biotechnology) for biodiversity characterization in archipelago of 572 emerald islands of Andaman and Nicobar islands has laid down some very interesting facts regarding the uniqueness in the floristic components. Baratang Islands have a rich and varied heritage of biodiversity, encompassing a large number of interesting species owing to their unique geographical location and isolation. The scattered nature, rainfall pattern, temperature and the prevailing humidity add in making the condition congenial. A substantial number of endemics have been reported from the region (Dagar, 1999). The field of Island Biogeography is the brainchild of Robert Mc Arthur and E.O. Wilson (1987), who describes immigration, dispersal and extinction rate of species. It summarizes that small islands have high vertical extinction rate as more species and fewer potential habitats are available to colonize. Larger islands have more horizontal extinction rate (relative to the number of species present) as more potential habitats and resources are available for use. Ecological status of the unique bio-rich zone of Baratang Islands needs proper inventory as information about the habitat conditions and

distribution pattern of floristics is essential for conservation prioritization. Taking into account the available literature, field observation and the occurrence points (collected using Global Positioning System (GPS), an integrated approach in the geospatial environment is proposed to trace the habitat characteristics of plant species.

Characterizing the habitat of *Amorphophallus longistylus* (Family Araceae, Sub family-Aroideae) would help to generate a database for its conservation. It is a herbaceous plant with a long peduncle, petiole is 2-3 feet green spotted with purple. Spathe is long and dull red in colour. Sheaths are closely wrapped at the base. *Amorphophallus longistylus* is a little known endemic and threatened plant species reported from Andaman Islands. It has 170 species distributed in tropical Africa, Madagascar, Tropical Asia and Australia (Mayo, 1997). In India, it is represented by about 16 species (Sivadasan and Jaleel, 1998). The Andaman and Nicobar Islands harbour three species viz., *Amorphophallus longistylus*, *Amorphophallus carnosus* and *Amorphophallus campanulatus*. The species *Amorphophallus longistylus* was first collected by Kurz in 1886. It was recollected after 131 years from, Panchwati, Middle

Andaman, in 1998 during a field survey by Sivadasan and Jaleel. They also provided detailed characteristics of the species that could help in its identification and reported its flowering season as May and June. The study is segregated in two phases. In the first, the occurrence of the species was traced in all islands of the group. The reconnaissance and field data was done to collect information on the species distribution. The observation results have been summarized in table 1. It was observed that it has restricted occurrence in few islands and narrow amplitude of distribution. During the second phases of the

study, a detailed survey was carried out in Baratang Forest Division to trace location points of the species (Table 2). During field data collection, it was seen to occur in moist deciduous and semi evergreen formations. The distribution pattern of this tuberous herb in terms of number of individuals recorded from different forest types in Baratang Forest Division is shown below (fig. 1). This information provides the pattern of species distribution and highlights the compositional pattern of the vegetation communities. The species most favorable habitat was semi-evergreen and moist deciduous forest.

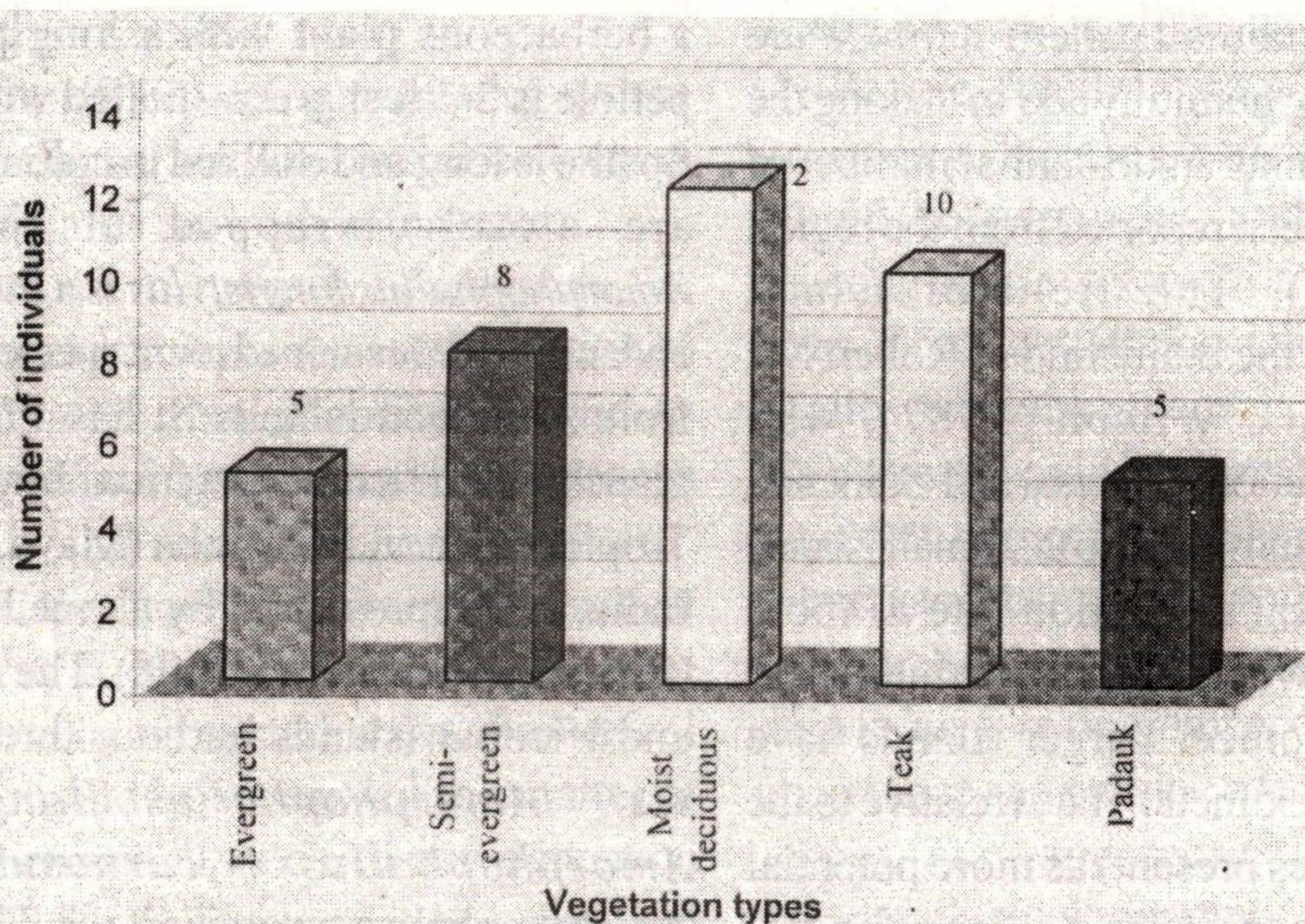


Fig. 1 Distribution of *Amorphophallus longistylus* in different vegetation strata

Table 1 Tracing the occurrence pattern and distribution status of *Amorphophallus* sp. in Andaman and Nicobar Islands

Species	North Andaman		Middle Andaman		Baratang Islands		South Andaman		Little Andaman	
	R	O	R	O	R	O	R	O	R	O
<i>Amorphophallus longistylus</i> Kurz	-	-	+	+	+	+	+	+	-	-
<i>Amorphophallus carnosus</i> Engl.	+	+	+	-	-	-	+	-	-	-
<i>Amorphophallus campanulatus</i> (Roxb.) Bl.ex Decne	+	-	+	-	-	-	+	+	-	-

R: Recorded O: Observed during field visit

Table 2 : Location points of the specie occurrence

Vegetation Type	Location	GPS Lat	GPS Long
Semi-evergreen	Near Bamboo Nala Basti, Kanchangarh, Baratang	12 11 24	92 46 29.3
Padauk Plantation	South creek, Baratang	12 10 14.9	92 47 18.8
Teak Plantation	South creek, Baratang	12 10 8.1	92 47 20.4
Moist Deciduous	Foreign Tikri, South creek, Baratang	12 12 9.7	92 47 40.4
Semi-evergreen	Jarawa Creek, Baludera Beach, Baratang	12 8 31.8	92 47 29.0
Padauk Plantation	1 km from diversion near South creek Baratang	12 10 4.7	92 47 16.6
Moist Deciduous	Adajig, Baratang	12 13 3.4	92 47 41.5
Semi-evergreen	4 km away from Baludera, Baratang	12 8 37.9	92 47 26.1
Moist Deciduous	Towards South Creek, Baratang	12 14 39.5	92 48 31.9
Semi-evergreen	Near Adajig, Baratang	12 15 29.6	92 47 16.7
Tropical Evergreen	Near water Tank, Adajig, Baratang	12 14 57.2	92 48 38.7
Tropical Evergreen	Nala near Adajig, Baratang	12 14 51	92 48 35.1
Semi-evergreen	Adajig, Baratang	12 17 34.7	92 47 40.2
Semi-evergreen	South Creek, Baratang	12 11 18.7	92 47 8.5
Moist Deciduous	Lorazig, Baratang	12 13 27.9	92 48 58.3

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Recommendations made in the National Symposium on “Conservation of Wild Tigers in Orissa”

held on 16th & 17th February 2003.

Having understood the problems of tigers in the wild and their habitat in Orissa and realising the urgent need for their sustainable conservation, the National Symposium on ‘Conservation of Wild Tigers in Orissa’ held at Bhubaneswar on the 16th and 17th February 2003, recommends that:-

1. Biodiversity conservation in general and tiger and other endangered floral and faunal species in particular have been the driving force behind the creation of Protected Areas. Rich tiger habitats outside and away from Simlipal also should be brought under the umbrella of Project Tiger for execution of planned developmental activities and implementation with monitoring and evaluation. **Specific recommendation is for immediate notification of “Satkosia - Baisipalli” (recently cleared by the Project Tiger Steering Committee) in central Orissa as a Tiger Reserve.**

2. **Sunabeda Sanctuary in the state of Orissa harbours the second highest number of tigers after Simlipal, (24 nos).** This patch of forests is contiguous with the Udanti-Sitanadi sanctuaries in Chhatisgarh through the Khariar forests, and with Udanti-Sitanadi having been cleared for inclusion under the Project Tiger scheme by the Steering Committee, there is an urgent need for placing the Sunabeda forests under the Project Tiger scheme. **The specific recommendation in this regard is for immediate submission of proposal for Sunabeda Tiger Reserve by the State Government.** These contiguous patches are potential rich habitats for Hard ground Barasingha and Wild Buffalo.

3. Over the years, the Protected Area network has expanded to various forest types and biodiversity locations. The symposium focussed on the status of tiger population and potential areas needing priority for protection, conservation and improvement of habitat. **It strongly recommends to notify the forests of ‘Narayanpatna’, Gupteswar, ‘Gandhamardhan’, ‘Kapilash’, ‘Malayagiri’ and ‘Chandrapur’ as sanctuaries.**

4. The Simlipal Tiger reserve with richest biodiversity is the only area of Orissa under Project Tiger. Project efforts till now have been successful in conservation of tigers and web of nature in Simlipal that sustains life. Simlipal Tiger Reserve has the largest concentration of tigers in Orissa. The specific recommendations are :-

There is need for co-ordination between various government agencies to eliminate incompatible activities of many departments which impinges upon the protection and development of tiger habitats as well as communities in and around Simlipal Tiger Reserve.

Relocation of remaining villages in the core area should be completed within a time frame along with livelihood programmes for relocated families to minimize on limiting factors of Tiger Reserve.

The forces of Central Reserve Police Force/Central Industrial Security Force with concurrence of Central Government should be immediately deployed for effective conservation measures and results.

5. Voluntary relocation of villages, with financial support from the Union Ministry of Environment and Forests, prioritized on the basis of prevailing ground situation, from inside the Protected Areas, should be undertaken with involvement of concerned communities, Non Governmental Organisations anthropologists/Sociologists, related Govt. Departments etc. with a nodal monitoring agency for this in place.

6. Number of rich forest areas are waiting declaration as Reserve Forests in the Three former undivided districts of Ganjam, Phulbani and Koraput. It is strongly recommended to expeditiously complete the process to make them Reserved Forests as they are rich and potential tiger habitats.

7. The contiguous forests of Baliguda, Kotgarh-Subarnagiri, Ghumsur, Boudh having a presence of 20 tigers, should be taken into consideration while formulating plans for any developmental activity in the region affecting forest land.

8. There is a need to address the basic and motivational requirement of field staff working in the remote areas of the Protected Areas and other forests. A system of rewards and recognition in the line of 'President's Medal', 'Governor's Medal' and 'Forest Medal' (like Police Medal) should also be introduced.

9. There are a large number of vacancies among the field staff in the forest department and the average age of staff at present is quite high, which impedes their efficiency in difficult and inhospitable terrain. These vacancies should not be frozen but immediately filled up and all necessary facilities may be provided to them.

10. Well conceived eco-development programmes should be taken up in villages around Protected Areas for economic growth of the people hitherto dependent on the forests and enlist their support for conservation efforts.

11. The present and potent tiger habitats should be clearly delineated in every division and there should be no diversion of forest land from the said forest areas under the Forest Conservation Act 1980.

12. People of the country should be provided opportunities in the form of 'Eco-tourism' for exposure, learning and appreciation of natural heritage for conservation benefits. Eco-tourism should therefore be allowed with involvement of local communities, for their economic benefit, as the next best option to total segregation from Protected Areas.

13. All the field officers in tiger habitats should be given immunity of using firearms for wildlife protection. A dedicated well trained 'Forest Protection Force' need to be created immediately. Magisterial powers to Wildlife Wardens and ACF's should also be given for the Protected Areas. All arms license within 10 Kms of Protected Areas should be cancelled.

14. The State Wildlife Advisory Board has not been convened for a long time. **With the amendments to the Wildlife Protection Act in force, the 'State Wildlife board' should be expeditiously constituted for it's functions.**

15. People residing inside and outside PA's should be provided with Identity Cards to prevent unauthorized encroachments. No lease should be granted within the Protected Area limits to outsiders.

16. The second tiger crisis due to international demand for tiger skins, bones and other parts is looming large. **There is need to establish a 'Forensic Laboratory' in Orissa for wildlife crimes. Further there is a need to establish State and District level Committees for collaboration and co-ordination with State and Central Enforcement agencies for intelligence sharing and for prevention and detection of wildlife crimes.**

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1. The aims and objects of the Society are as follows :-

- (a) To promote interest and impart knowledge regarding the preservation and conservation of all forms of wildlife, particularly among the youth of the country.
- (b) To cooperate with the Govt. of India and State Governments and with others Societies and Institutions having similar aims and objects in working for the interests of wildlife.
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- (d) To advise and help the Govt. and wildlife administrators in the formation, maintenance and protection of Sanctuaries and National Parks, preservation of wildlife in general and endangered species of India in particular and in the introduction of exotic species into the country, rehabilitation of endangered species etc. and in the formulation and amendments of rules and acts, so as to conserve and increase wildlife stocks.
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